Service Manual

Diagnostic Audiometer AD226

Part number 80671106
Valid from serial no. 746702

Contents

Contents **1**

General Technical Specifications **2**
- Specification of input/output connections 3
- Calibration properties 4
- Survey of reference values for pure tone audiometer calibration 4

Disassembly **6**
- Electrical Assembling Instrument 6

Schematics **7**
- Block Diagram 7
- Main board Diagram 8
  - Component Index 13
  - Keys and Led's Index 14
  - Component Partlist 15
- Connector Board A Diagram 18
  - Component Index and Partlist 19
- Connection Board B Diagram 20
  - Component Index and Partlist 21
- Fuse PCB 22

Calibration Procedure **23**
- Service, adjustment and repair 23
  - Equipment for adjustment 23
- Hardware Calibration 23
  - Calibration of Attenuator in channel 1 23
  - Calibration of Attenuator in channel 2 24
  - LCD angle adjustment 25
- Software Calibration 25
  - General Description 25
  - Tone Calibration 25
  - Narrow Band Calibration 25
  - White Noise Calibration 26

Appendix A Technical Description of the RS232 Interface version 2.00 ..... **1**
- General Specification 1
- Control Wires 2
- Communication 3
- Audiological Information 4
- Test Results 5
- Controlling the AD226 6
- AD226 Status 7
- EEPROM Control 9
  - Programming Tips 9
- AD226 OnLine 9
  - Examples of Transmission 9
- Window Routines in C++ 10
  - Transmit Data from PC to Instrument 10
  - Receive Data from Instrument 11

Appendix B Setting of Set-up items **1**
- Introduction 1
- Set-up Items 1
  - Set-up item 3 CRC Check 2
  - Set-up item 8 Bekesy Deviation 3
  - Set-up item 13 Buzzer 4
  - Set-up item 18 Bone Type 5
  - Set-up item 22 ABLB Pulse Time 6
  - Set-up item 27 dB Value 7
  - Set-up Item 32 OSHA Level 8

Appendix AD226 U Update News **1**

General Technical Specifications

Medical CE-mark:	The CE-mark indicates that Interacoustics A/S meets the requirements of Annex II of the Medical Device Directive 93/42/EEC. Approval of the quality system is made by TÜV - identification no. 0123.	
Standards:	**Safety:**	IEC 60601-1, Class I, Type B (using UPS400 external power supply)
	EMC:	IEC 60601-1-2
	Audiometer:	IEC 60645-1/ANSI S3.6 , Type 3 Tone audiometer
Power:	UPS400 External power supply See description in separate Service Manual	
Fuses:	2xT1A + 1xT2A located on PCB	
Operation environment:	**Temperature:**	15 – 35 °C
	Rel. Humidity:	30 – 90%
Transport temperature::	-20-50°C	
Storage temperature:	0-50°C	
Warm up time:	3 minutes at room temperature (20 °C).	

Functions

Signal sources:	**Tone:**	11 pure tone and warble test frequencies in the range of 125 – 8000Hz
	Masking:	Narrow band noise, in 11 bands. White noise.
Inputs:	**Pat. response**	Connection for patient response switch. Response lamp will light when activated.
	Power UPS400	Connection for external power supply.
Outputs:	**Earphone Right / Left:**	Can be selected to be either standard earphones or insert phones by pressing *shift* Right/Left.
	Bone conductor:	Masking in Right or Left earphone can be selected.
	Insert masking phone	For use of CIR22.
	MTP10:	Use of MTP10 as printer device
	Printer:	Laser printer with HP GL2 language Ink jet or matrix printer using IBM mode (optional) Desk jet printers using HP PCL L3 language (optional)
	RS232	Input/output for computer communication. See separate section in Service Manual for programming details
Patient Communication:	**Talk Forward:**	Operator to patient communication. 10 – 110 dB continuously adjustable on the operation panel
Attenuator:	-10 to 120 dB in 1 or 5 dB steps for tone and speech. The upper 20 dB is accessed by pressing the +20 dB button. 0 – 110 dB in 1 or 5 dB steps for masking noise.	
Tone Switch:	Silent touch switch for soft presentation of signals. Tone lamp will light when activated.	
Tone presentation:	**Manual:**	Tone is presented by activation of Tone Switch.
	Reverse:	Tone is interrupted by activation of Tone Switch.
	Pulse:	Single pulse or automatic pulsing with selectable on/off times of 250 – 5000ms.
Auto Threshold:	Patient controlled Hughson-Westlake test according to ISO 8253-1 with automatic storing of the threshold values in the internal memory. Patient response is open for 2 seconds after signal presentation. 2 out of 3 or 3 out of 5 correct responses can be selected.	
Békésy:	Pure tone or narrow band stimulation. Fixed frequency. Continuous and pulsed tone.	
Buzzer:	If selected, it will indicate end of automatic test.	
Special test types:	**SISI:**	With automatic score calculation (5 dB included for familiarisation).
	Stenger:	Binaural pure tone or speech stimulation.

	Langenbeck	Tone in noise.
Store	**When activated, the displayed values for AC L/R, BC L/R are stored in the internal memory.**	
	Stored values can be printed out on a printer if connected.	
Synchronous Masking:	Locks Channel 2 attenuator to Channel 1 attenuator.	
Channel 2 options:	Output of Channel 2 can be set up to be either Narrow Band or White noise.	

Frequencies and maximum intensities

Frequency	**Air conduction**		**Bone conduction**	**Insert Masking**
	TDH39	EAR-Tone 3A	B71	NB/WN
Hz	dB HL	dB HL	dB HL	dB HL
125	90	90	--	--
250	110	105	45	105
500	120	110	65	110
750	120	115	70	110
1000	120	120	70	110
1500	120	120	70	110
2000	120	120	75	110
3000	120	120	80	110
4000	120	115	80	105
6000	120	100	55	95
8000	110	95	50	90

Specification of input/output connections

Inputs	**Connector type**	**Electrical properties**	
Power UPS400	DIN, 5 pole	Pin 1 and 2:	0V
		Pin 3:	+5V
		Pin 4:	-12V
		Pin 5:	+12V
Patient response	Jack, 6.3mm stereo	Handheld switch:	Switches 5V to the logic input. (The switch current is 40mA)
Outputs:			
Phones, Left/ Right	Jack, 6.3mm mono	Voltage:	Up to 5.5V rms. by 10Ω load
		Min. load impedance:	5Ω
Bone conductor	Jack, 6.3mm mono	As for Phones, Left/Right	
Insert masking phone	Jack, 6.3mm mono	Voltage:	Up to 5.5V rms. by 100Ω load
		Min. load impedance:	100Ω
Data I/O:			
RS232C	9 pole Cannon	RS232 serial port for communication	See appendix A in service manual for detailed information
MTP10	9 pole Cannon	Serial port	For use of MTP10 as printing device.
Printer	25 pole Cannon	Parallel port	Standard connection for laser printer, using HPGL2 language.
			By addition of a built-in adapter (IPA26), the range of printers are increased:
			IPA26 is not longer available.
			Desk jet printer, using HP PCL L3 language.
			Matrix and Inc Jet printers using IBM mode.

Other electrical specifications:

Warble	5 Hz sine, ±5% modulation

Calibration properties

Calibrated Transducers:	Earphones:	Telephonics TDH39 with a static force of 4.5N ±0.5N
	Bone conductor:	Radioear B71 with a static force of 5.4N ±0.5N
	Insert phones:	E·A·R Tone 3A (Option)
	Insert masking phone:	CIR22 (Option)
Accuracies:	Generally the instrument is made and calibrated to be within and better than the tolerances required in the specified audiometer standards:	
	Frequency:	±1%
	Pure tone levels:	±3 dB for 125 – 4000Hz
		±5 dB for 6000 – 8000Hz

Tone calibration standards and spectral properties:

Earphones	Pure tone:	ISO 389-1/ ANSI S3.6 for TDH39.
	Narrow band noise:	ISO 389-1 / ANSI S3.6 + ISO 389-4 values
	– Spectral properties:	IEC 60645-1, Narrow band noise
	White noise:	SPL
	– Spectral properties:	IEC 60645-1, White noise
Bone conductor	Pure tone:	ISO 389-3 / ANSI S3.6. Valid for placement on the human mastoid
Insert phones	Pure tone:	ISO 389-2
	Narrow band noise:	ISO 389-2+ ISO 389-4 values
	– Spectral properties:	IEC 60645-1, Narrow band noise, electrically measured.
	White noise:	SPL
	– Spectral properties:	IEC 60645-1, White noise, electrically measured.
Insert masking phone	Narrow band noise:	ISO 389-2 + ISO 389-4 values
	– Spectral properties:	IEC 60645-1, Narrow-band noise, electrically measured.
	White noise:	SPL
	– Spectral properties:	IEC 60645-1, White noise, electrically measured.

Survey of reference values for pure tone audiometer calibration

Freq. [Hz]	**ISO 389-1 (TDH39)** [dB re. 20 µPa]	**ANSI S3.6 (TDH39)** [dB re. 20 µPa]	**ISO 389-4 (ISO 8798) (NB masking)** [dB re. 20 µPa]	**ISO 389-3 (ISO 7566) (BC)** [dB re. 1µN]	**ANSI S3.6 (BC)** [dB re. 1µN]	**ISO 389-2 (Insert)** [dB re. 20 µPa]	**ISO 389-7 Free field (FF)** [dB re. 20 µPa]	**ISO 389-7 Diffuse-field (FF)** [dB re. 20 µPa]
125	45,0	45	4			26	22,0	22,0
250	25,5	25,5	4	67	67	14	11,0	11,0
500	11,5	11,5	4	58	58	5,5	4,0	3,5
750	7,5	8	5	48,5	48,5	2	2,0	1,0
1000	7	7	6	42,5	42,5	0	2,0	0,5
1500	6,5	6,5	6	36,5	36,5	2	0,5	-1,0
2000	9	9	6	31	31	3	-1,5	-1,5
3000	10	10	6	30	30	3,5	-6,0	-4,0
4000	9,5	9,5	5	35,5	35,5	5,5	-6,5	-5,0
6000	15,5	15,5	5	40		2	2,5	-0,5
8000	13	13	5	40		0	11,5	5,5

Coupler types used by calibration

- TDH39 is calibrated using a 6cc acoustic coupler made in accordance to IEC 303
- Insert phones are calibrated using a 2cc acoustic coupler made in accordance to IEC 126
- Bone Conductor is calibrated using a mechanical coupler made in accordance to IEC 373

General properties for earphones

Sound attenuation values for earphones		
Frequency	Attenuation	
	TDH39 with MX41/AR or PN 51 cushion	EAR-Tone 3A
[Hz]	[dB]	[dB]
125	3	32.5
160	4	-
200	5	-
250	5	36
315	5	-
400	6	-
500	7	37.5
630	9	-
750	-	-
800	11	-
1000	15	36.5
1250	18	-
1500	-	-
1600	21	-
2000	26	33
2500	28	-
3000	-	-
3150	31	-
4000	32	39.5
5000	29	-
6000	-	-
6300	26	-
8000	24	42.5

General about Specifications

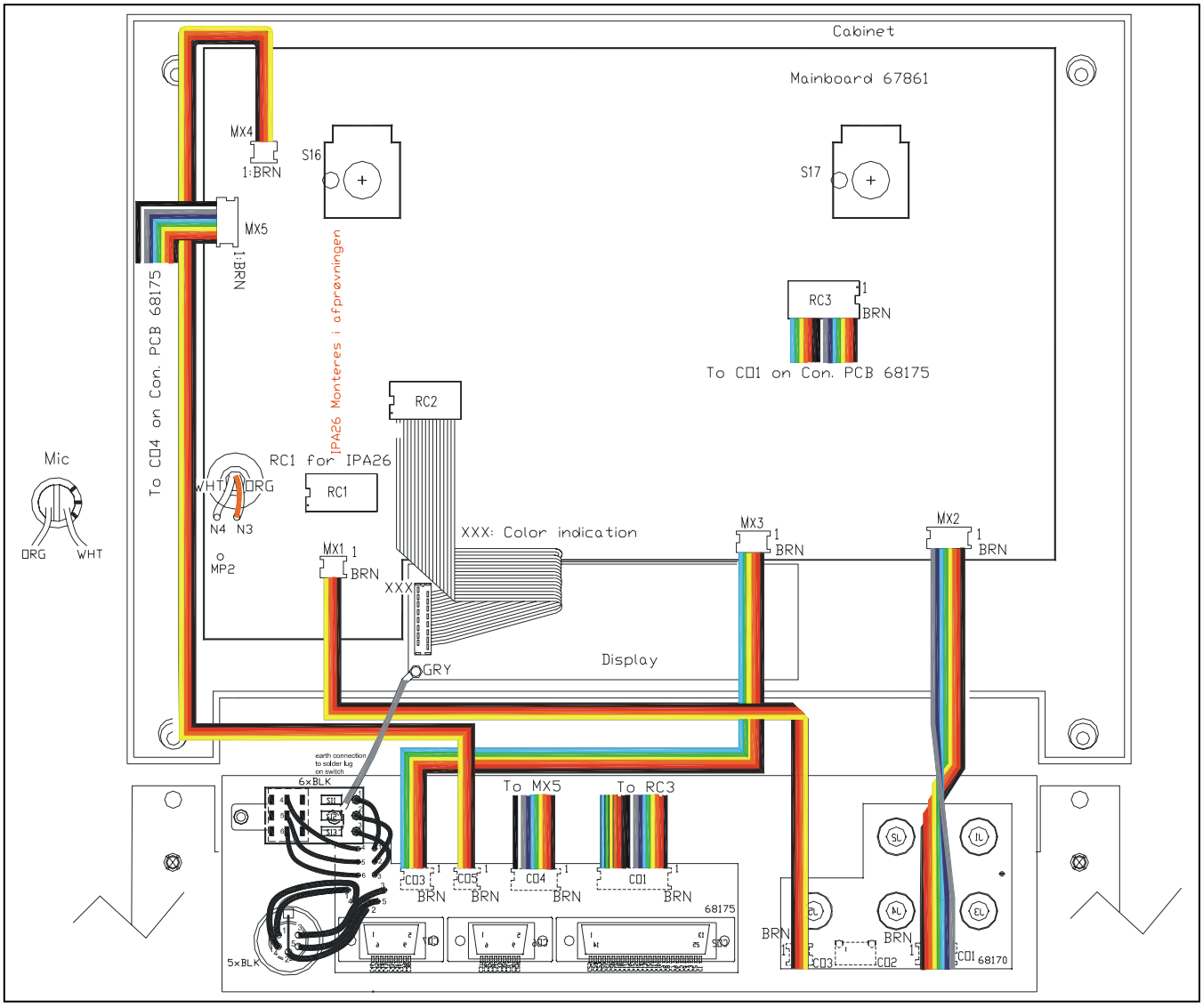
Interacoustics continuously strive to improve the products and their performance. Therefore the specifications can be subject to change without notice.
The performance and specifications of the instrument can only be guarantied if it is subject to a technical maintenance at least once a year. This should be made by a workshop, authorised by Interacoustics.
Questions about representatives and products may be sent to:

Interacoustics A/S	Phone:	+45 63713555
Drejervaenget 8	Fax:	+45 63713522
DK 5610 Assens	email:	info@interacoustics.com
Denmark	http:	www.interacoustics.com

Disassembly

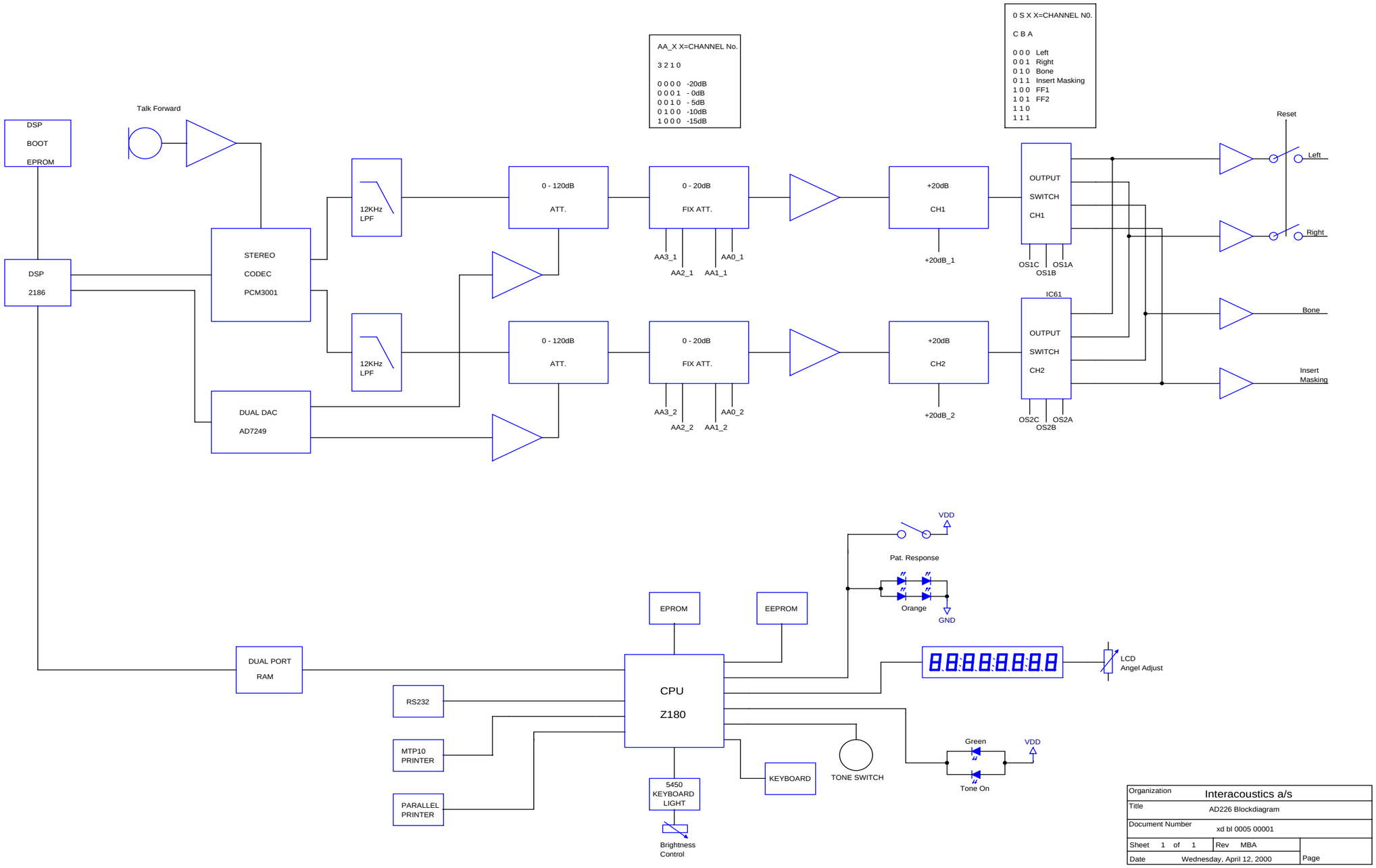
Electrical Assembling Instrument

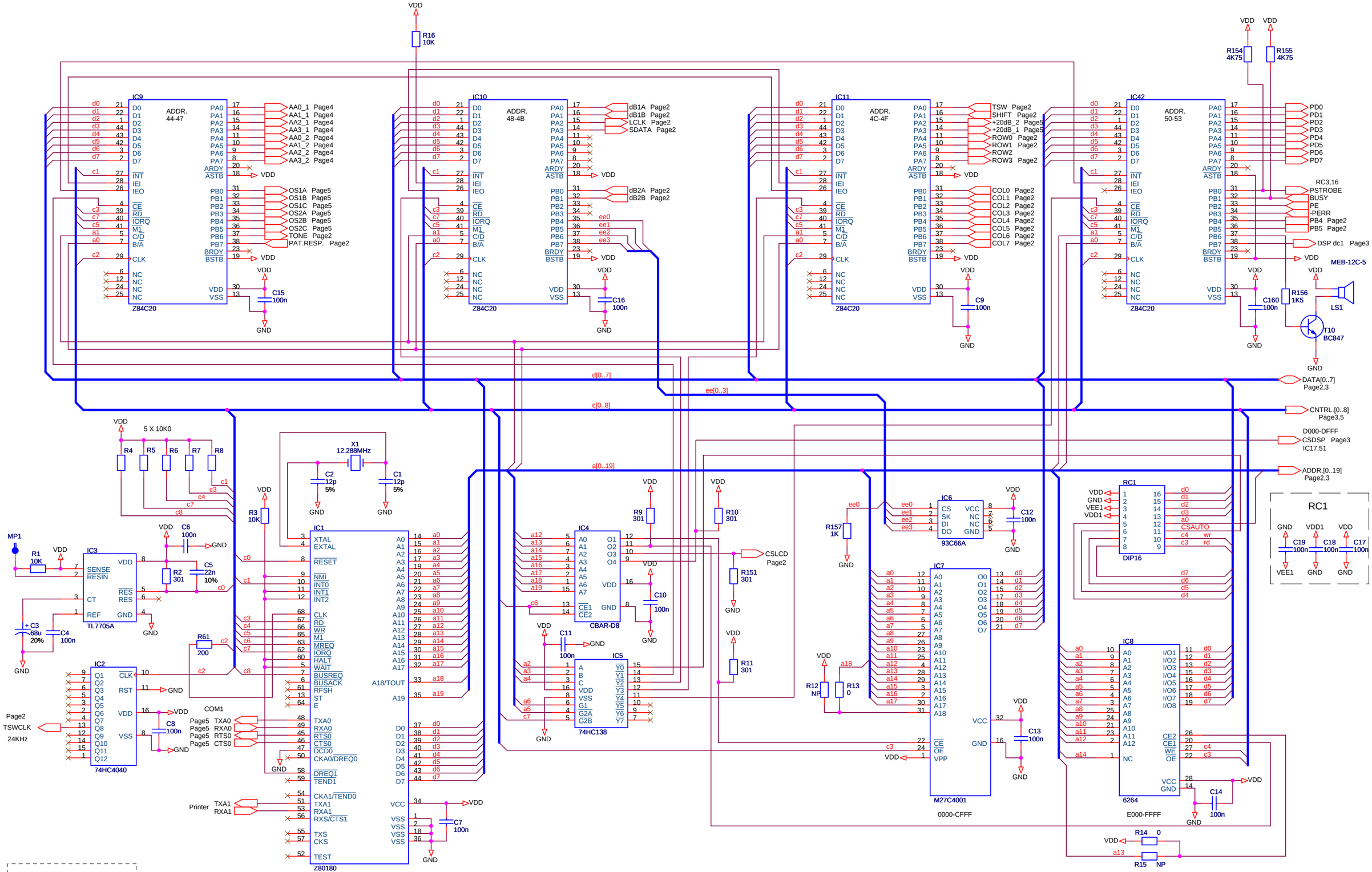
I06013601



Schematics

Block Diagram



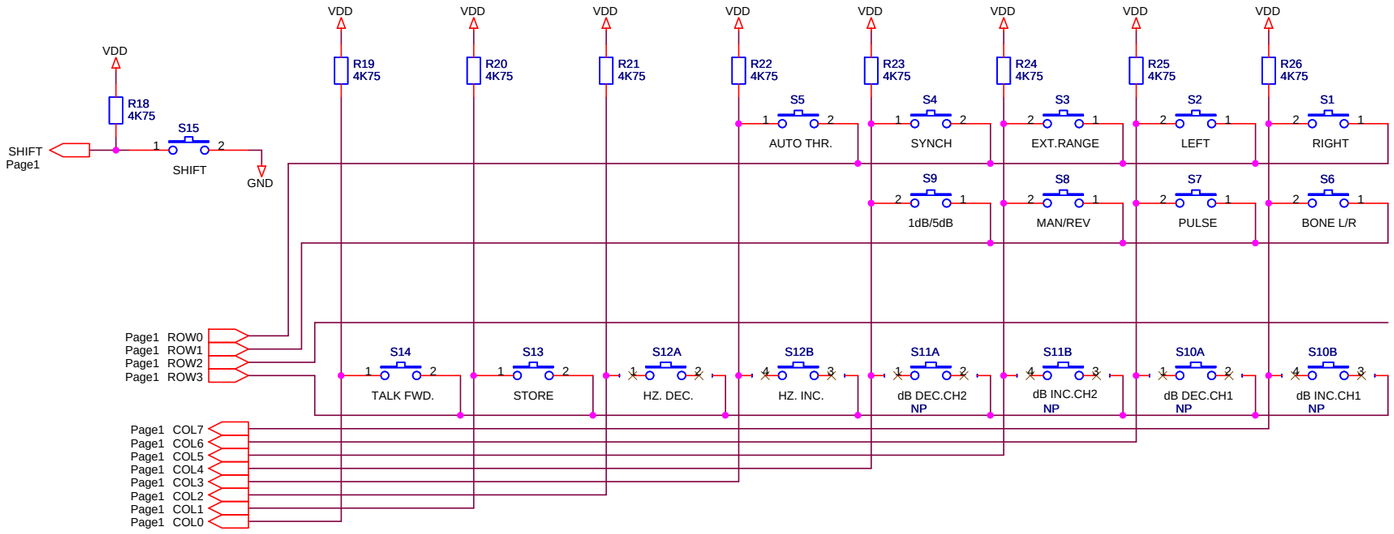


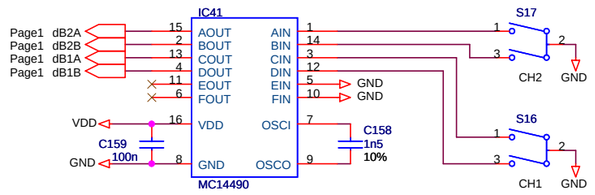
POWER SUPPLY CONNECTIONS

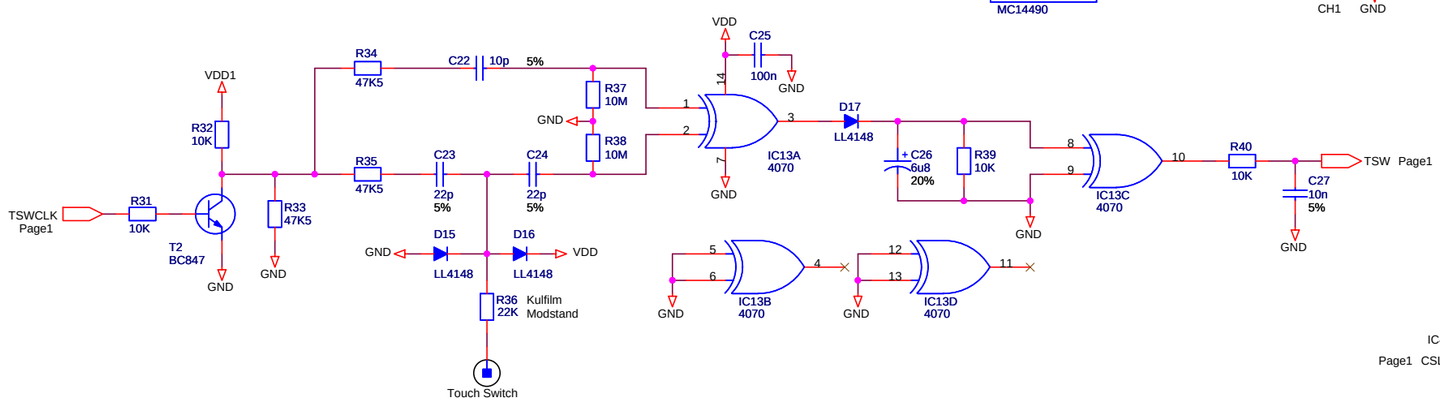
Digital Supply	VDD = +5V GND = 0V
Analog Supply	VDD1 = +12V VDDA = +5V GND = 0V VEE1 = -12V

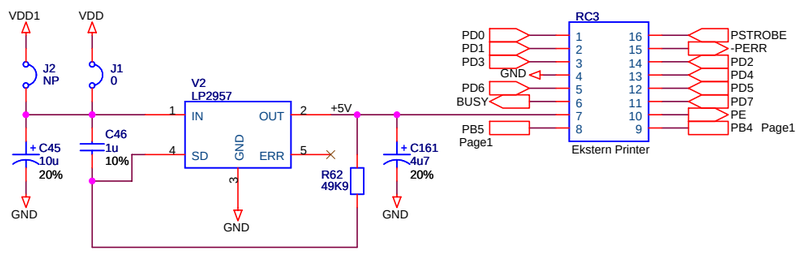
NP = Not Present

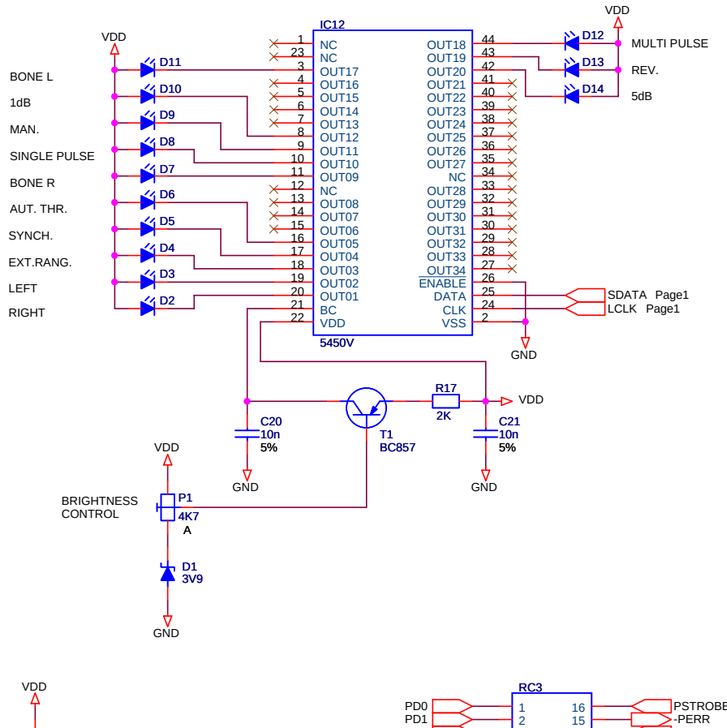
Interacoustics A/S			
	Date	Constr.	Approved
Construction	091098	MBA	IBP
Revision	030506	PSC	HBJ
Title	Mainboard 071		
Partno.	69011001	Sheet 1 of 5	
Drawingno.	D02003702		

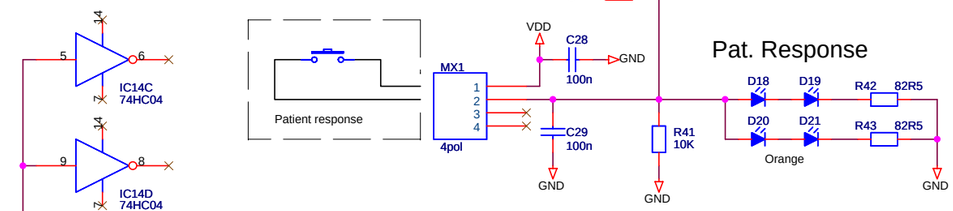


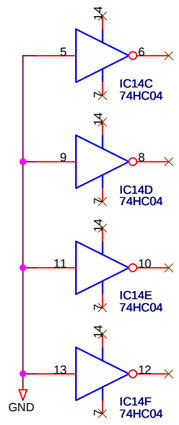


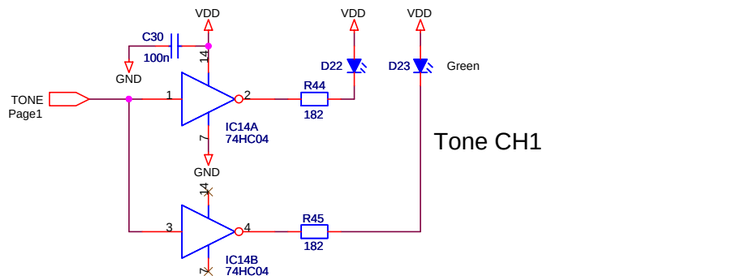


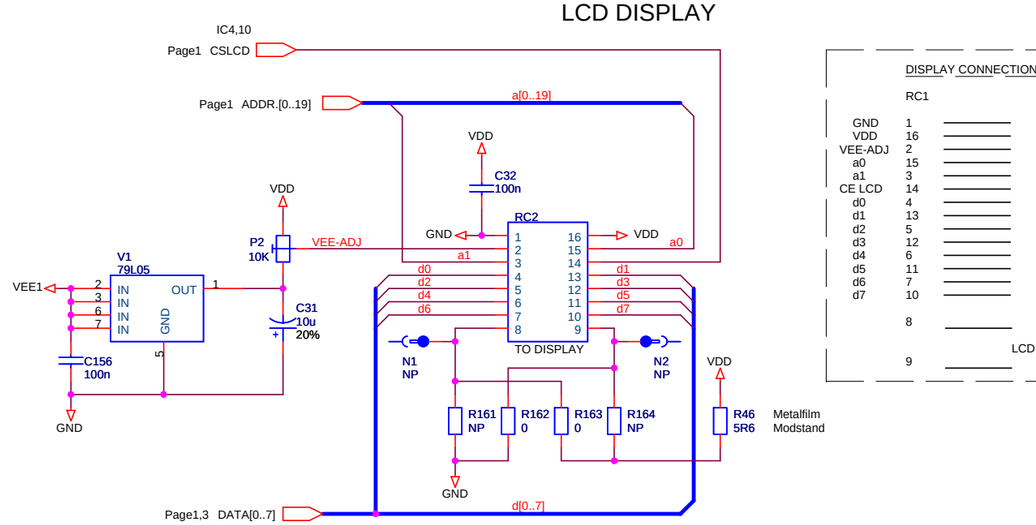












DISPLAY CONNECTION

	RC1		LCM-523
GND	1	1	VSS
VDD	16	2	VDD
VEE-ADJ	2	3	V 0
a0	15	4	R S
a1	3	5	R/W
CE LCD	14	6	E
d0	4	7	DB0
d1	13	8	DB1
d2	5	9	DB2
d3	12	10	DB3
d4	6	11	DB4
d5	11	12	DB5
d6	7	13	DB6
d7	10	14	DB7
	8		
			LCD BACKLIGHT
	9		

POWER SUPPLY CONNECTIONS

Digital Supply	VDD = +5V GND = 0V
Analog Supply	VDD1 = +12V VDDA = +5V GND = 0V VEE1 = -12V

NP = Not Present

Interacoustics A/S			
	Date	Constr.	Approved
Construction	091098	MBA	IBP
Revision	030506	PSC	HBJ
Title	Mainboard 071		
Partno.	69011001	Sheet 2 of 5	
Drawingno.	D02003702	Page 9	

IC15
ADSP-2184
XTAL
CLKIN
CLKOUT
RESET
BR
BG
BGH
IOMS
BMS
DMS
CMS
PMS
WR
RD
IRQ2+PF7
IRQL1+PF6
IRQL0+PF5
IRQE+PF4
PF3
PF2[MODE C]
PF1[MODE B]
PF0[MODE A]
PWD
PWDACK
IWR/D7
IRD/D6
IAL/D5
IS/D4
IACK/D3
IAD15/D2
IAD14/D1
IAD13/D0
IAD12/A13
IAD11/A12
IAD10/A11
IAD9/A10
IAD8/A9
IAD7/A8
IAD6/A7
IAD5/A6
IAD4/A5
IAD3/A4
IAD2/A3
IAD1/A2
IAD0/A1
A0
TFS1
RFS1
SCLK1
DR1
DT1
TFS0
RFS0
SCLK0
DR0
DT0
VDD
GND
EMS
EE
ECLK
ELOUT
ELIN
EINT
EBR
EBG
ERESET
D23
D22
D21
D20
D19
D18
D17
D16
D15
D14
D13
D12
D11
D10
D9
D8
FL0
FL1
FL2

IC16
27C010
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
O0
O1
O2
O3
O4
O5
O6
O7
CE
OE
PGM
VPP
VCC
GND
NC

IC17
IDT7130SA20J
A0R
A1R
A2R
A3R
A4R
A5R
A6R
A7R
A8R
A9R
A0L
A1L
A2L
A3L
A4L
A5L
A6L
A7L
A8L
A9L
D0R
D1R
D2R
D3R
D4R
D5R
D6R
D7R
D0L
D1L
D2L
D3L
D4L
D5L
D6L
D7L
CSR
R/WR
BUSYR
INTR
OER
CSL
R/WL
BUSYL
INTL
OEL
VDD
GND

IC45
74HC4040
CLK
RST
VDD
GND
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12

IC46A 74HC04
IC46B 74HC04
IC46C 74HC04
IC46D 74HC04
IC46E 74HC04
IC46F 74HC04

IC19
PCM3001
VinL
Cin+L
Cin-L
VrefL
VrefR
Cin+R
Cin-R
VinR
CLKIO
XTI
XTO
VoutL
VoutR
VCOM
VDD
DGND
VccADC
GNDADC
VccDAC
GNDDAC
LRCIN
BCKIN
DIN
DOUT
RSTB
FMT0
FMT1
FMT2

IC20A OP275
IC20B OP275

IC21
AD7249
REFOUT
REFIN
SCLK
SDIN
SYNC
CLR
LDAC
BIN/COMP
RA
VOUTA
VOUTB
RB
VDD
DGND
VSS
AGND

IC18
OP27

X2 16.67MHz
X3 12.288MHz

DSP dc1 Page1
ADDR.[0..19] Page1
DATA[0..7] Page1,2
CSDSP Page1
CNTRL.[0..8] Page1

DSP CONTROL BUS
DSP ADDRESS BUS
DSP DATA BUS
dc[0..6]
da[0..13]
dd[8..23]
a[0..19]
d[0..7]
c[0..8]

MIC. PRE.AMP.
MIC.
N3 NP
N4 NP

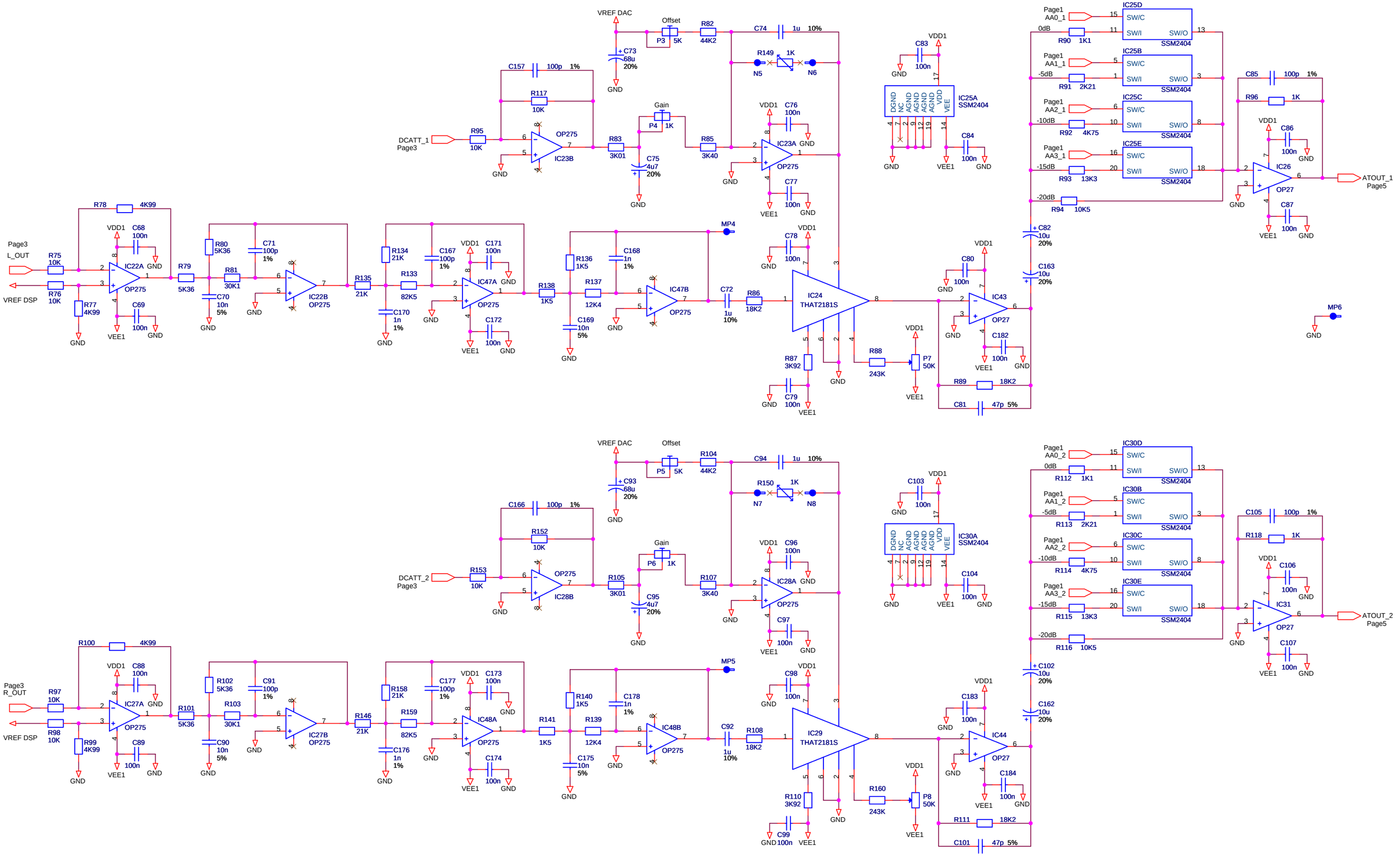
L_OUT Page4
R_OUT Page4
DCATT_1 Page4
DCATT_2 Page4
VREF DSP
VREF DAC
MP3
MP9
MP11

POWER SUPPLY CONNECTIONS

Digital Supply	VDD = +5V GND = 0V
Analog Supply	VDD1 = +12V VDDA = +5V GND = 0V VEE1 = -12V

NP = Not Present

Interacoustics A/S			
	Date	Constr.	Approved
Construction	091098	MBA	IBP
Revision	030506	PSC	HBJ
Title	Mainboard 071		
Partno. 69011001		Sheet 3 of 5	
Drawingno. D02003702		Page 10	



POWER SUPPLY CONNECTIONS

Digital Supply	VDD = +5V GND = 0V
Analog Supply	VDD1 = +12V VDDA = +5V GND = 0V VEE1 = -12V

NP = Not Present

Interacoustics A/S			
	Date	Constr.	Approved
Construction	091098	MBA	IBP
Revision	030506	PSC	HBJ
Title	Mainboard 071		
Partno.	69011001	Sheet 4 of 5	
Drawingno.	D02003702	Page 11	

OUTPUT SWITCH

CH1

Page1 +20dB_1 → IC32C SSM2402 (SW/C, SW/I, SW/O) → ATOUT_1 Page4

MP7 · C108 4u7 20% · R119 14K3 · +20dB CH1

+20dB

IC32A SSM2402 (GND, NC, VDD, VEE) · C110 100n · C111 100n · VDD1 · VEE1

R120 1K3 · VDDA · C109 100n

IC33 4051 (X, X0–X7, VDD, VSS, VEE, INH, A, B, C)

R121 1K · Page1 OS1C · Page1 OS1B · Page1 OS1A

CH2

Page1 +20dB_2 → IC32B SSM2402 (SW/C, SW/I, SW/O) → ATOUT_2 Page4

MP8 · C112 4u7 20% · R122 14K3 · +20dB CH2

R123 1K3 · VDDA · C113 100n

IC34 4051 (X, X0–X7, VDD, VSS, VEE, INH, A, B, C)

R124 1K · Page1 OS2C · Page1 OS2B · Page1 OS2A

LEFT

R125 3K01 · C114 100p 1% · C115 22p 5%

IC50 OP27 · VDD1 · VEE1 · GND_LEFT · C119 100n · C120 100n

T3 MJD122 · T4 MJD127 · R126 100

C116 220n 20% · C117 220n 20% · C118 220n 20% · R127 10

RIGHT

R128 3K01 · C121 100p 1% · C122 22p 5%

IC51 OP27 · VDD1 · VEE1 · GND_RIGHT · C126 100n · C127 100n

T5 MJD122 · T6 MJD127 · R129 100

C123 220n 20% · C124 220n 20% · C125 220n 20% · R130 10

RL1 · RL2 SMD11A05 · VDD · LEFT OUT · RIGHT OUT

CNTRL.[0..8] Page1 · c[0..8] · c0

RESET

D31 LL4148 · R109 4K75 · MDC3105LT1 T7 · C100 10u 20%

BONE

R142 3K01 · C130 100p 1% · C131 22p 5%

IC52 OP27 · VDD1 · VEE1 · GND_BONE · C135 100n · C136 100n

T8 MJD122 · T9 MJD127 · R143 100

C132 220n 20% · C133 220n 20% · C134 220n 20% · R144 10 · BONE OUT

INSERT

C137 100p 1% · R145 1K96

IC53 OP27 · VDD1 · GND_INSERT · C138 100n · C139 100n · INS OUT

MX2 · GND_LEFT · GND_RIGHT · GND_BONE · GND_INSERT

Mounted on the jack-socket. (rearplate) · 4 x 100pF · Chassis

Printer

VDD · R147 10K · TXA1 · RXA1

IC39 MAX202 (T1I, T2I, R1O, R2O, T1O, T2O, R1I, R2I, C1+, C1-, C2+, C2-, VDD, V+, V-, GND)

C145 1u 10% · C146 1u 10% · C147 1u 10% · C148 1u 10% · C149 1u 10%

MX4 Printer

To PC

VDD1 · R148 2K · Page1 TXA0 · Page1 RTS0 · Page1 RXA0 · Page1 CTS0

IC40 MAX202 (T1I, T2I, R1O, R2O, T1O, T2O, R1I, R2I, C1+, C1-, C2+, C2-, VDD, V+, V-, GND)

C150 1u 10% · C151 1u 10% · C152 1u 10% · C153 1u 10% · C154 1u 10% · C155 100n

MX5 To PC (DSR, RXD, TXD, CTS, DTR, VDD, GND)

C140 100n · C141 100n · C142 100n

From External Power Supply · MX3 (VDD1, GND, VEE1, VDD, GND)

D32 SL23 · D33 SL23 · D29 NP · D30 NP

POWER SUPPLY CONNECTIONS

Digital Supply	VDD = +5V	
	GND = 0V	
Analog Supply	VDD1 = +12V	
	VDDA = +5V	
	GND = 0V	
	VEE1 = -12V	

V3 78L05 · C143 10n 5% · C144 10u 20% · MP10

HF1 Chassis · C179 100n

HF3 Chassis · C180 100n

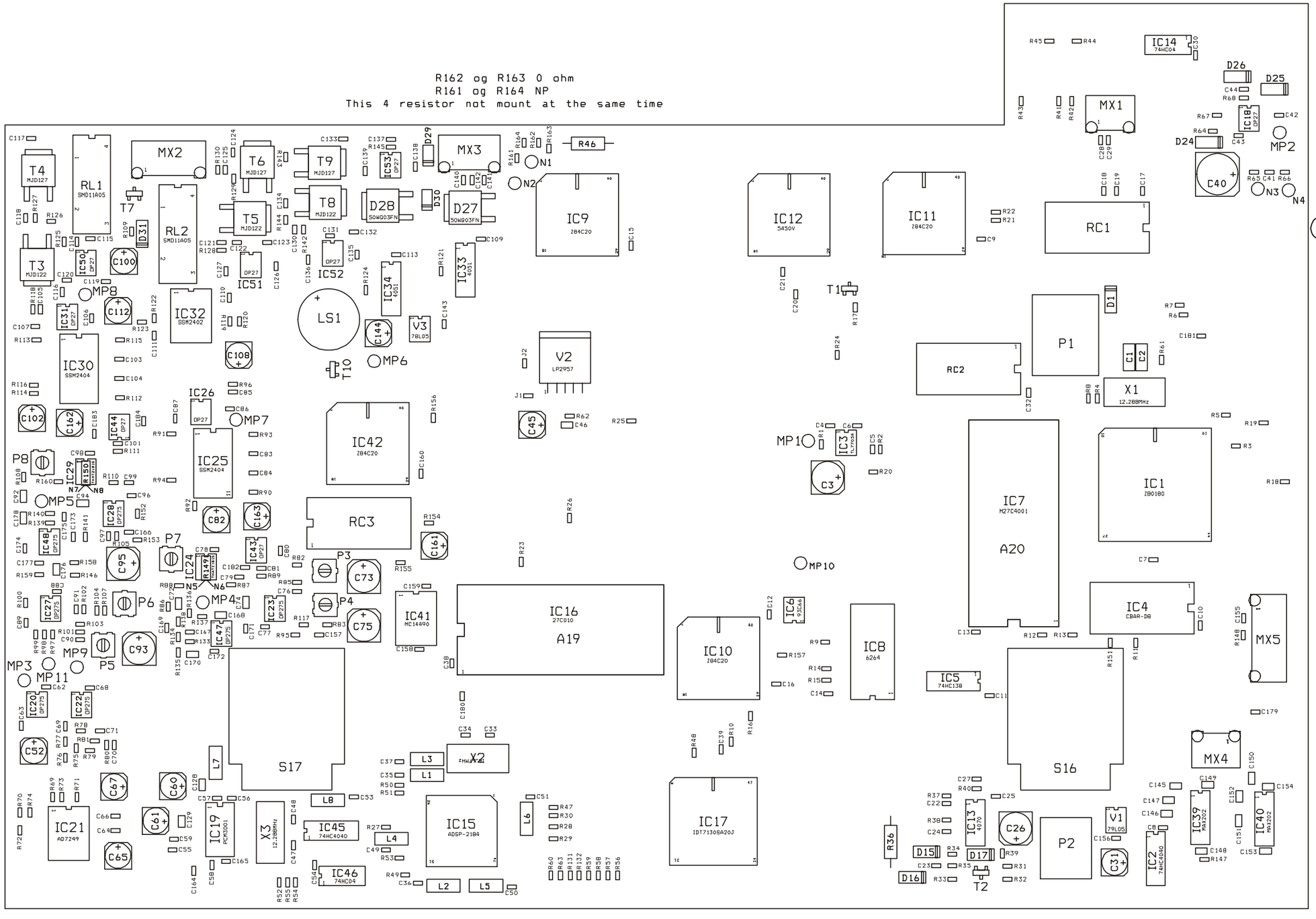
HF5 Chassis · C181 100n

NP = Not Present

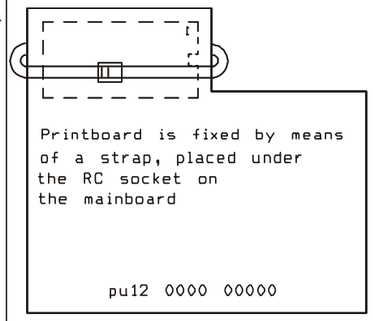
Interacoustics A/S			
	Date	Constr.	Approved
Construction	091098	MBA	IBP
Revision	030506	PSC	HBJ
Title	Mainboard 071		
Partno.	69011001	Sheet	5 of 5
Drawingno.	D02003702		Page 12

Component Index

R162 og R163 0 ohm
R161 og R164 NP
This 4 resistor not mount at the same time



IPA26 Option
printer adapter for IBM
printer mode
is mounted in the RC1 socket



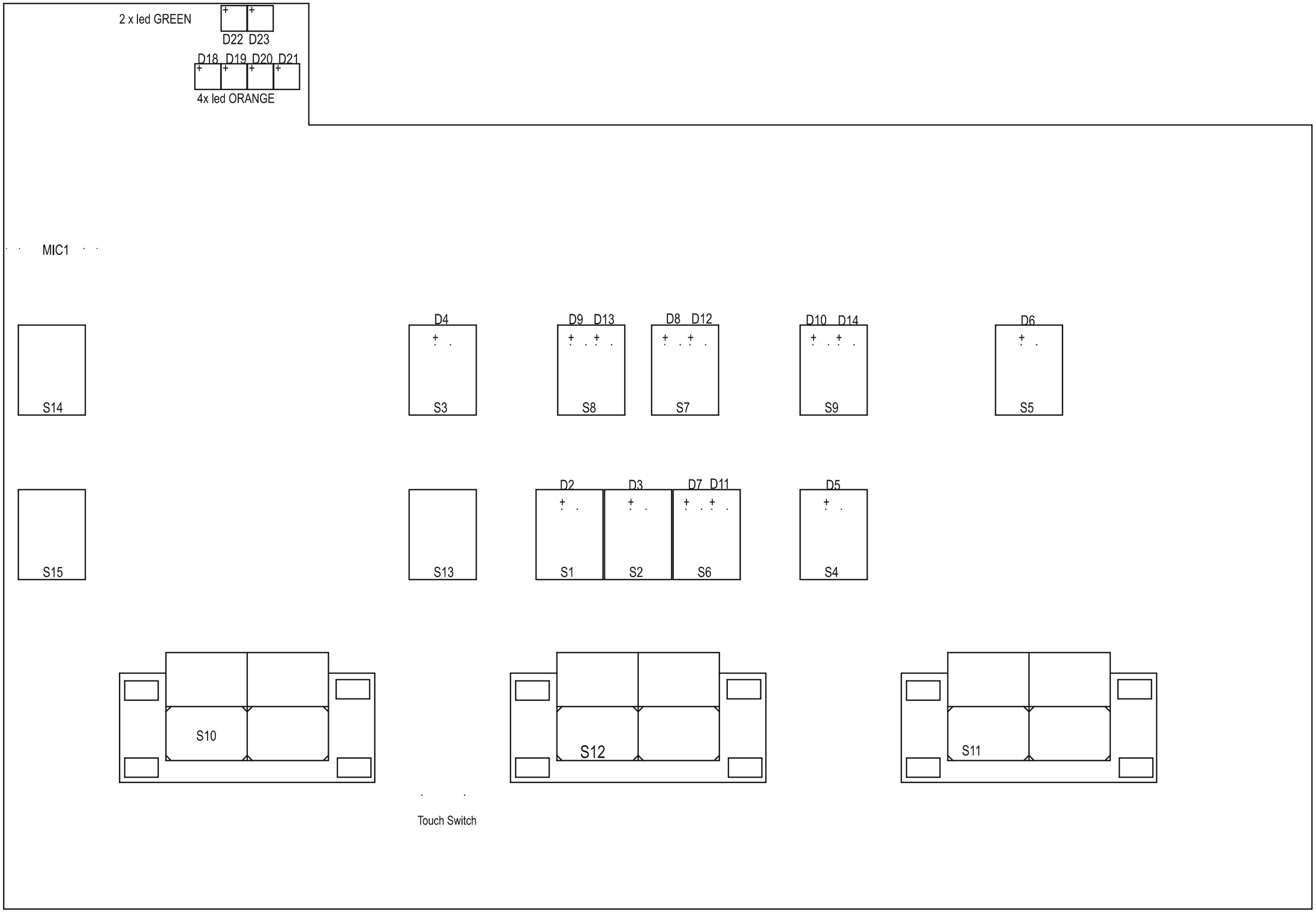
Interacoustics A/S			
	Date	Constr.	Approved
Construction	040396	AMJ	IBP
Revision	151205	AMJ	IBP
Title	Mainboard 071		
Partno.	69011001		Sheet 1 of 1
Drawingno.	D01004001		

Component Partlist

Assembled Board PCA 51001902

Quantity	Part Reference	Part Number	Value	Tolerance
2	A1 A2	45108401	Labels	
4	A3 A4 A5 A6	35500201	pertinaxskive	
2	A7 A8	36309201	tast_0	
1	A9	36309301	tast_0	
1	A10	36307301	tast_1	
1	A11	36307501	tast_1	
1	A12	36307401	tast_1	
2	A13 A14	36307101	tast_1	
3	A15 A16 A17	36307201	tast_2	
1	A18	36307701	tast_2	
2	A19 A20	75800801	DIP32	
4	A21 RC1 RC2 RC3	75801301	DIP16	
2	C1 C2	61420301	12p	5%
3	C3 C73 C93	61000301	68u	20%
86	C4 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C25 C28 C29 C30 C32 C35 C36 C37 C38 C39 C42 C43 C49 C50 C51 C53 C54 C62 C63 C64 C66 C68 C69 C76 C77 C78 C79 C80 C83 C84 C86 C87 C88 C89 C96 C97 C98 C99 C103 C104 C106 C107 C109 C110 C111 C113 C119 C120 C126 C127 C135 C136 C138 C139 C140 C141 C142 C155 C156 C159 C160 C171 C172 C173 C174 C179 C180 C181 C182 C183 C184	61401101	100n	10%
1	C5	61400101	22n	10%
9	C20 C21 C27 C44 C70 C90 C143 C169 C175	61401001	10n	5%
1	C22	61415301	10p	5%
9	C23 C24 C33 C34 C47 C48 C115 C122 C131	61400501	22p	5%
1	C26	61002701	6u8	20%
11	C31 C45 C52 C65 C67 C82 C100 C102 C144 C162 C163	61000201	10u	20%
1	C40	61003001	100u	20%
13	C41 C56 C57 C58 C116 C117 C118 C123 C124 C125 C132 C133 C134	61401201	220n	20%
17	C46 C72 C74 C92 C94 C128 C129 C145 C146 C147 C148 C149 C150 C151 C152 C153 C154	61401601	1u	10%
2	C55 C59	61401501	470p	5%
7	C60 C61 C75 C95 C108 C112 C161	61000501	4u7	20%
14	C71 C85 C91 C105 C114 C121 C130 C137 C157 C164 C165 C166 C167 C177	61400201	100p	1%
2	C81 C101	61407901	47p	5%
1	C158	61400901	1n5	10%
4	C168 C170 C176 C178	61401801	1n	1%
1	D1	61700101	3V9	
13	D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12 D13 D14	71700101	LED	
6	D15 D16 D17 D25 D26 D31	61700201	LL4148	
4	D18 D19 D20 D21	71700301	LED	
2	D22 D23	71700201	LED	
1	D24	61700501	6V2	
2	D32 D33	61700301	SL23	
1	HF1		Earthgnd	

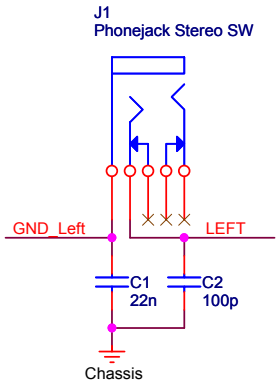
Keys and Led's Index



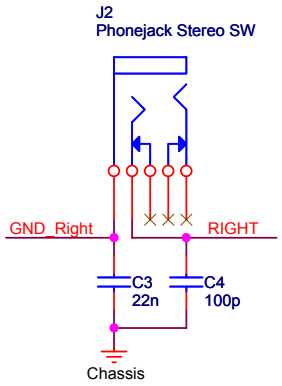
Quantity	Part Reference	Part Number	Value	Tolerance
1	HF3		Earthgnd	
1	HF5		Earthgnd	
1	IC1	62000101	Z80180	
4	IC10 IC11 IC9 IC42	62002601	Z84C20	
1	IC12	62000201	5450V	
1	IC13	62000301	4070	
2	IC14 IC46	62000401	74HC04	
2	IC2 IC45	62000901	74HC4040	
1	IC15	62000501	ADSP-2184	
1	IC16	72000101	27C010	
1	IC17	62000601	IDT7130SA20J	
9	IC18 IC26 IC31 IC43 IC44 IC50 IC51 IC52 IC53	62031601	OP27	
1	IC19	62000801	PCM3001	
7	IC20 IC22 IC23 IC27 IC28 IC47 IC48	62000701	OP275	
1	IC21	62001001	AD7249	
2	IC24 IC29	62001101	THAT2181S	
2	IC25 IC30	62001201	SSM2404	
1	IC3	62001401	TL7705A	
1	IC32	62002101	SSM2402	
1	IC4	72700501	CBAR-D8	
1	IC5	62001701	74HC138	
1	IC6	62002901	93C66A	
1	IC7	72000201	M27C4001	
1	IC8	62008801	6264	
2	IC33 IC34	62001601	4051	
2	IC39 IC40	62002201	MAX202	
1	IC41	62002301	MC14490	
8	J1 R13 R14 R54 R71 R72 R162 R163	60400101	0	1%
8	L1 L2 L3 L4 L5 L6 L7 L8	60204701	0	1%
1	LS1	76300501	MEB-12C-5	
11	MP1 MP2 MP3 MP4 MP5 MP6 MP7 MP8 MP9 MP10 MP11	74000101	MP	
2	MX1 MX4	75800201	4pol	
1	MX2	75801101	8pol	
1	MX3	75800601	6pol	
1	MX5	75810901	10pol	
1	P1	73400101	4K7	
1	P2	73400201	10K	
2	P3 P5	63400201	5K	
2	P4 P6	63400301	1K	
2	P7 P8	63403101	50K	
28	R1 R3 R4 R5 R6 R7 R8 R16 R28 R31 R32 R39 R40 R41 R49 R50 R51 R52 R66 R75 R76 R95 R97 R98 R117 R147 R152 R153	60400201	10K	1%
6	R2 R9 R10 R11 R48 R151	60401401	301	1%
2	R17 R148	60400901	2K	1%
16	R18 R19 R20 R21 R22 R23 R24 R25 R26 R64 R65 R92 R109 R114 R154 R155	60401101	4K75	1%
3	R27 R53 R61	60401801	200	1%
3	R29 R30 R47	60401701	100K	1%
3	R33 R34 R35	60402501	47K5	1%
1	R36	70100101	22K	5%
2	R37 R38	60402601	10M	1%
2	R42 R43	60425201	82R5	1%
2	R44 R45	60402801	182	1%

Quantity	Part Reference	Part Number	Value	Tolerance
1	R46	70106101	5R6	5%
14	R56 R57 R58 R59 R60 R63 R68 R96 R118 R121 R124 R131 R132 R157	60403601	1K	1%
1	R62	60420301	49K9	1%
4	R67 R127 R130 R144	60401301	10	1%
4	R77 R78 R99 R100	60403001	4K99	1%
4	R79 R80 R101 R102	60403101	5K36	1%
2	R81 R103	60403201	30K1	1%
2	R82 R104	60403301	44K2	1%
5	R83 R105 R125 R128 R142	60400701	3K01	1%
2	R85 R107	60403401	3K40	1%
4	R86 R89 R108 R111	60402401	18K2	1%
2	R87 R110	60403501	3K92	1%
2	R88 R160	60402701	243K	1%
2	R90 R112	60403701	1K1	1%
2	R91 R113	60403801	2K21	1%
2	R93 R115	60403901	13K3	1%
2	R94 R116	60404001	10K5	1%
2	R119 R122	60400801	14K3	1%
2	R120 R123	60401601	1K3	1%
3	R126 R129 R143	60401201	100	1%
2	R133 R159	60400401	82K5	1%
4	R134 R135 R146 R158	60400301	21K	1%
5	R136 R138 R140 R141 R156	60401901	1K5	1%
2	R137 R139	60402301	12K4	1%
1	R145	60416601	1K96	1%
2	R149 R150	70121901	1K	
2	RL1 RL2	64500101	SMD11A05	
12	S1 S2 S3 S4 S5 S6 S7 S8 S9 S13 S14 S15	36302001	SW PUSHBUTTON	
1	S12	51000301	XA4	
2	S16 S17	73900101	CODESWITCH	
1	SW1	Dummy	DIGITAST SYM	
1	T1	64600101	BC857	
2	T2 T10	64600401	BC847	
3	T3 T5 T8	64600201	MJD122	
3	T4 T6 T9	64600301	MJD127	
1	T7	62002701	MDC3105LT1	
1	V1	64300101	79L05	
1	V2	64300201	LP2957	1.4%
1	V3	64300301	78L05	
2	X1 X3	63201401	12.288MHz	
1	X2	63201501	16.67MHz	

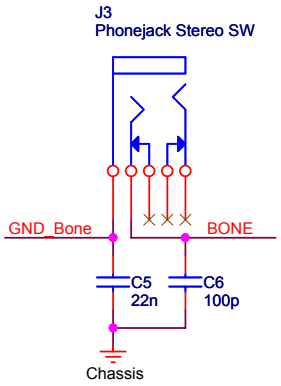
Left



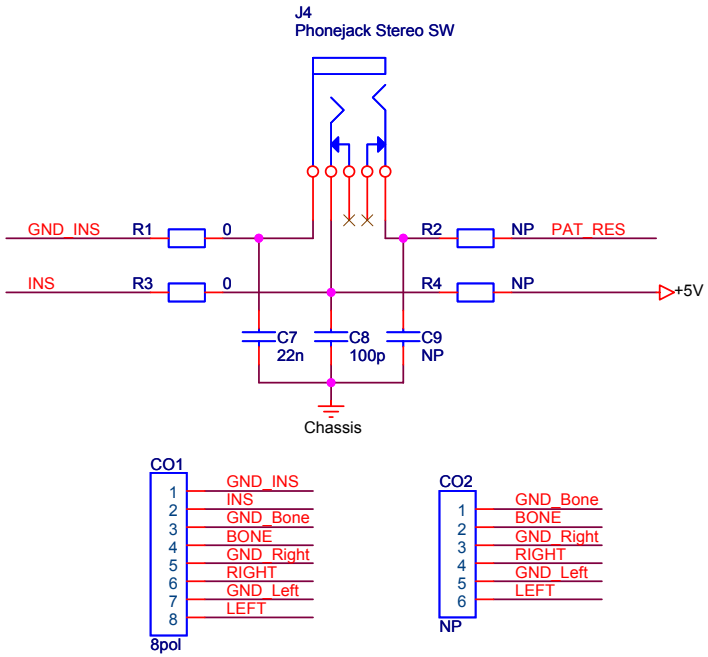
Right



Bone



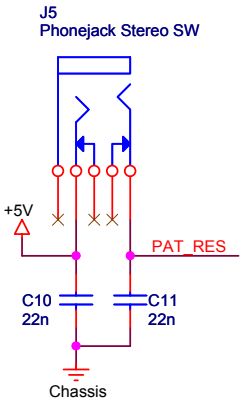
Model 071: InsertMask.
Model 093: Pat.Respose

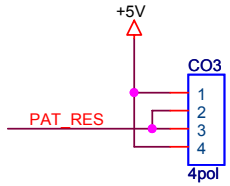


Mainboard 071: MX2
Model 093 = NP

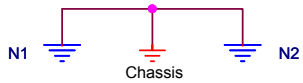
Model 071 = NP
Mainboard 093: MX1

Model 071: Pat.Response
Model 093 = NP





Mainboard 071: MX1
Display Board 093: MX3

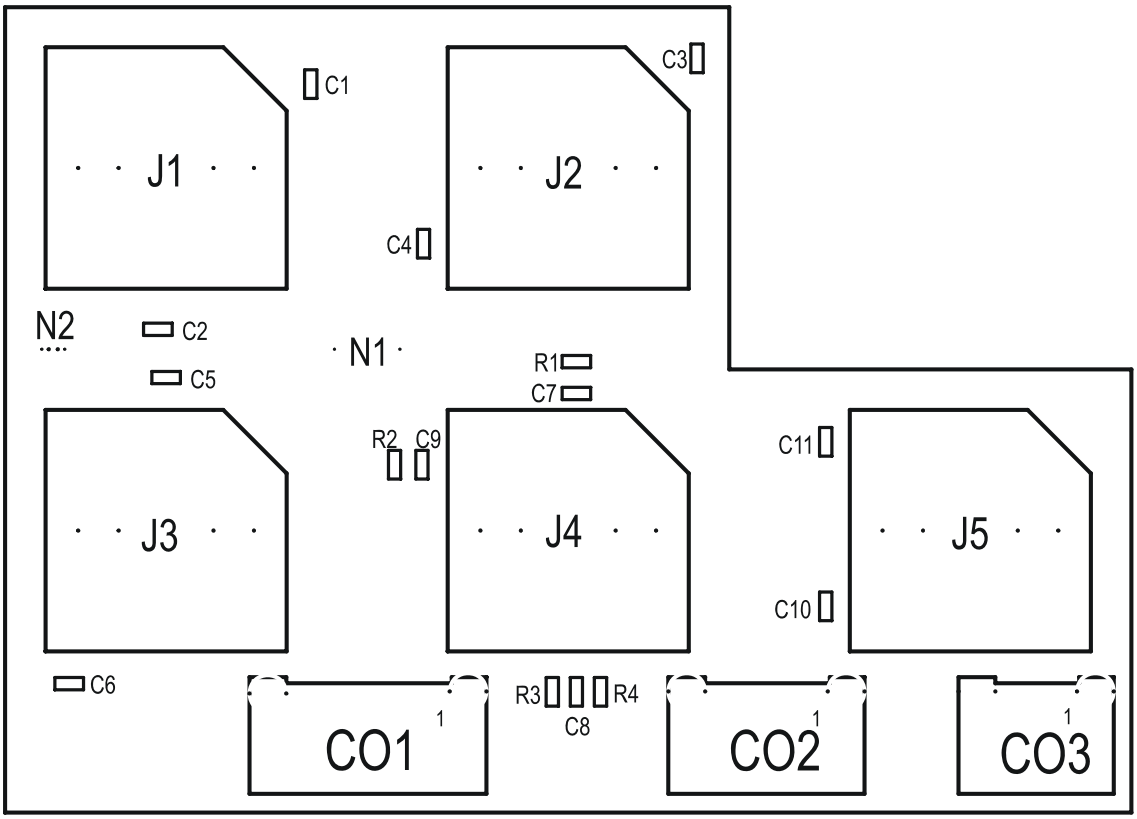


Presskrue-3mm Lodde ø

NP = Not Present

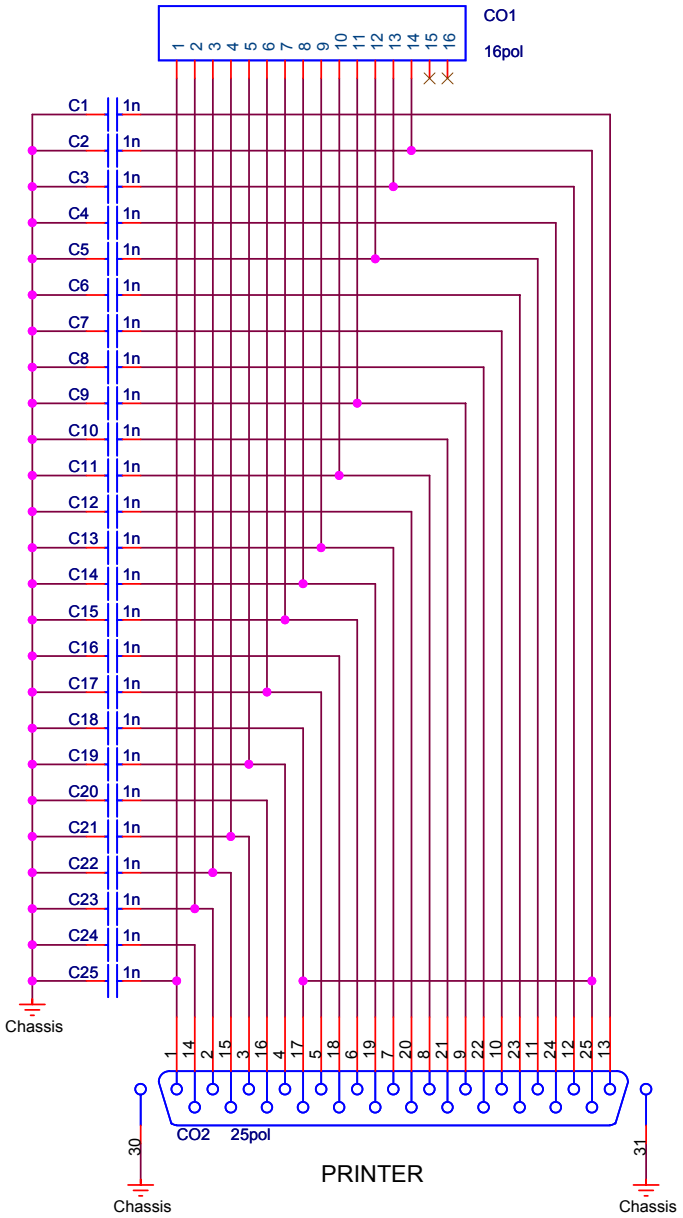
Interacoustics A/S			
	Date	Constr.	Approved
Construction	080403	PSC	TKJ
Revision	121250	PSC	TKJ
Title	Rear Panel 071/093		
Partno.	69011301	Sheet 1 of 1	
Drawingno.	D02002901 071	Page 18	

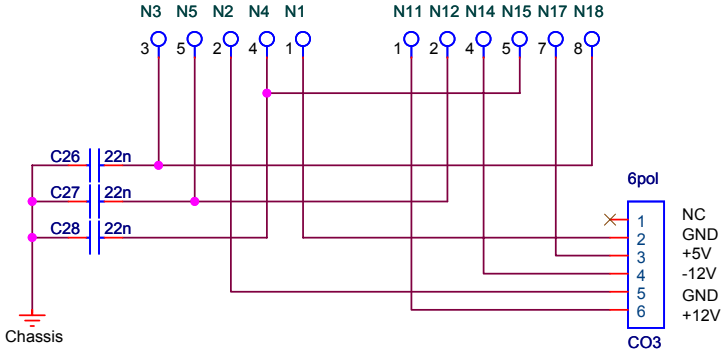
Component Index and Partlist



Quantity	Part Reference	Part Number	Value	Tolerance
2	A1 A2	65651	Labels	
6	C1 C3 C5 C7 C10 C11	60658	22n	10%
4	C2 C4 C6 C8	59751	100p	1%
1	CO1	42457	8pol	
1	CO3	42455	4pol	
5	J1 J2 J3 J4 J5	60120	Phone jack Stereo SW	
2	R1 R3	60324	0	1%

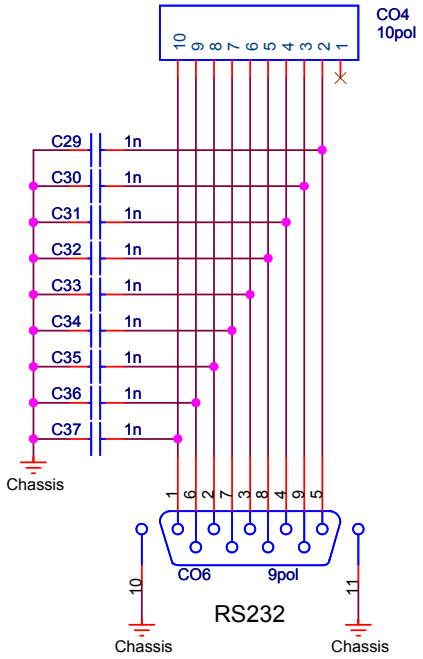
Mainboard 071: RC3
Mainboard 093: NP



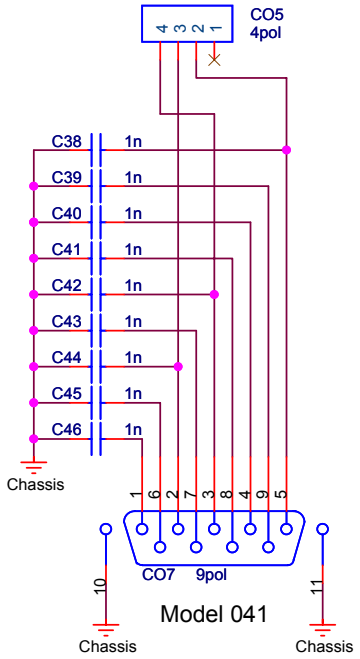


Mainboard 071: MX3
Mainboard 093: MX4

Mainboard 071: MX5
Mainboard 093: MX2



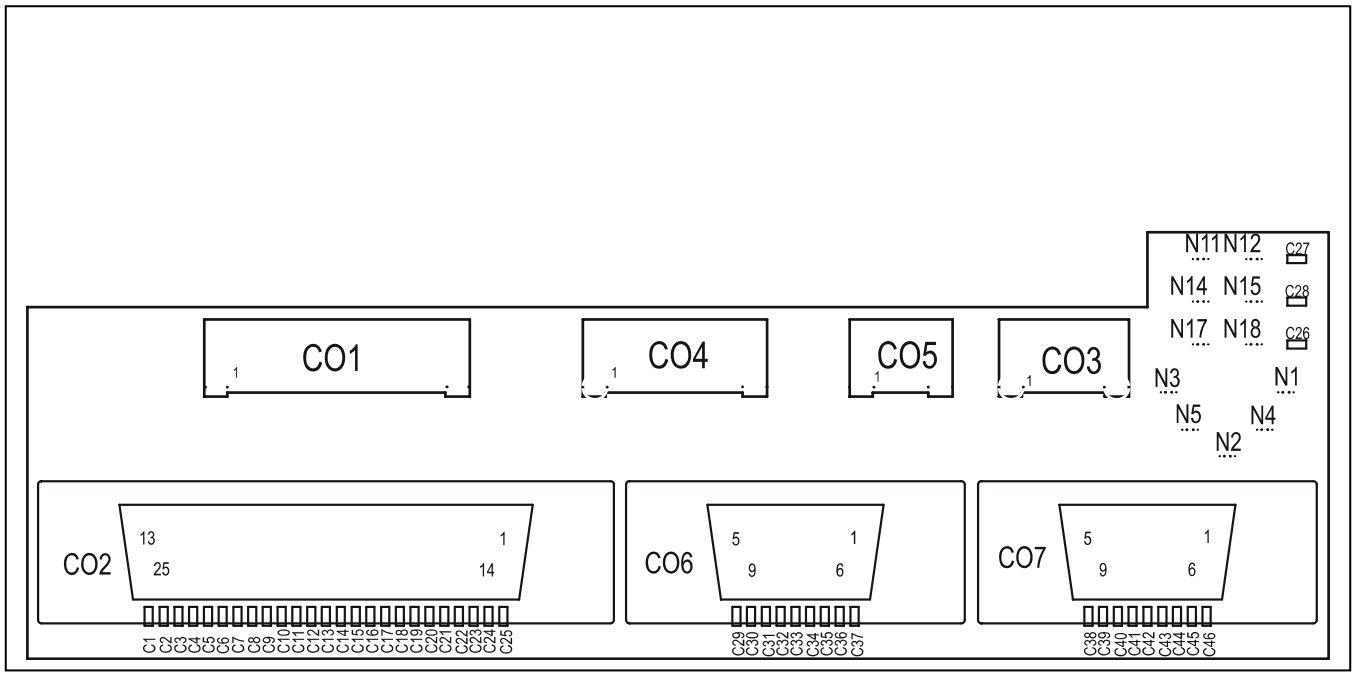
Mainboard 071: MX4
Mainboard 093: MX5



NP = Not Present

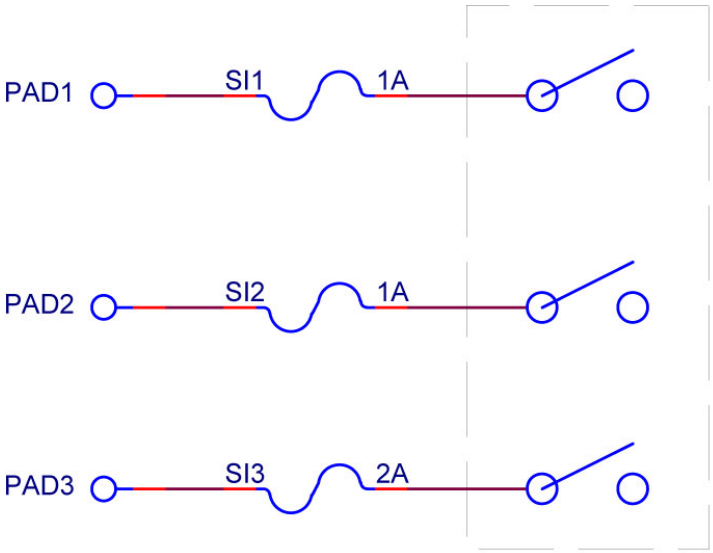
Interacoustics A/S			
	Date	Constr.	Approved
Construction	080403	PSC	TKJ
Revision	121205	PSC	TKJ
Title	Rear Panel B 071/093		
Partno. 69011401		Sheet 1 of 1	
Drawingno. D02003501 071		Page 20	

Component Index and Partlist



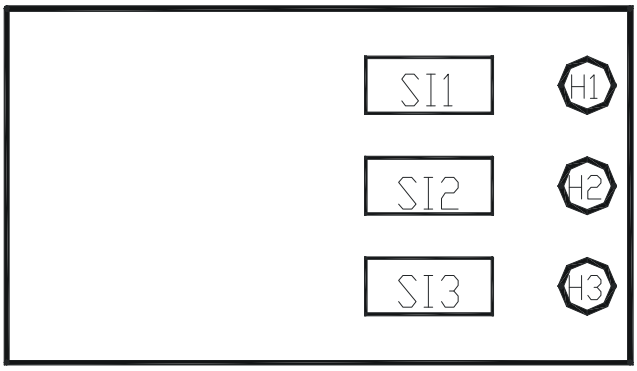
Quantity	Part Reference	Part Number	Value	Tolerance
2	A1 A2	65651	Labels	
43	C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23 C24 C25 C29 C30 C31 C32 C33 C34 C35 C36 C37 C38 C39 C40 C41 C42 C43 C44 C45 C46	66241	1n	10%
3	C26 C27 C28	60658	22n	10%
1	CO1	42461	16pol	
1	CO2	65898	25pol	
1	CO3	42456	6pol	
1	CO4	42458	10pol	
1	CO5	42455	4pol	
2	CO6 CO7	62179	9pol	

Fuse PCB



	Date	Constr.	Appr.	
Constr.	170107	PSC	OG	Sheet
Revision	190908	PSC	MPO	1 of 1
Title	Fuse PCB 071/072/073			
Interacoustics	Partno. 69029101			
	Drawingno. D02018402			

NP = Not Present



Interacoustics A/S			
	Date	Constr.	Approved
Construction	201206	PSC	OG
Revision	-	-	-
Title	Fuse PCB 071/072/073		
Partno.	69029101		Sheet 1 of 1
Drawingno.	D0101860101		

Fuses:
2x 1A 125V Slo-Blo part number 63600801
1x 2A 125V Slo- Blo part number 63601001

Calibration Procedure

Service, adjustment and repair

This instrument can be serviced, adjusted and repaired without loosening the validity of the CE-marking provided the measuring equipment used is fulfilling the demands below, the adjustment procedures are followed and the personnel is having the necessary qualifications approved by Interacoustics.

Equipment for adjustment

In order to assure correct calibration of the audiometric equipment, it is important that the necessary measuring equipment is present and that it is reliable and stable.

Minimum requirements for measuring equipment:

- Measuring amplifier with input for condenser microphone or a sound level meter, fulfilling the demands of IEC 651 Type 1.
- Acoustical coupler, 6cc and 2cc. Fulfilling the demands of IEC 308 and IEC 126.
- 1" pressure field condenser microphone for the above mentioned couplers, fulfilling the demands of IEC 1094-1.
- Artificial mastoid, fulfilling the demands of IEC 373.
- Furthermore it is recommended to have an acoustic calibrator for the control of the complete measuring chain.
- General purpose frequency counter.
- General purpose digital multimeter.

In order to be able to trace and monitor the signals it will be convenient also to have an oscilloscope.

Hardware Calibration

The calibration of AD226 is separated in two parts, a hardware calibration and a software calibration (sound level adjustment and modification register adjustment).

While keeping *shift* and Talk Forward buttons down, switch on power on the rearside of the instrument. The AD226 is now in software calibration menu. Wait 3 minutes, while the instrument stabilises.

All measuring points (MP) and potentiometers(P) are located on the main board, and measurements are made with reference to MP11 (GND) - see Main board Index page 13.

Calibration of Attenuator in channel 1

Select software calibration(see description above).
Select *shift* - Ext Range and the AD226 will turn to attenuator calibration menu. The display will show:

0 dB on channel 1 * step(s)

1. Connect an AC voltmeter to **MP4** and notice the output V1.

2. Connect the AC voltmeter to **MP7**.

3. Adjust **P3** until the AC voltmeter shows exactly 20 dB more than V1. Notice the output V2.

4. Press Frequency Decr. and the display will show:

-60 dB on channel 1 * step(s)

5. Adjust **P4** until the AC voltmeter shows exactly 60 dB less than V2.

6. Press Frequency Decr. and the display will show.

-120 dB on channel 1 * step(s)

Notice: Point 7 can only be done by use of an AC voltmeter with 1000 Hz band pass filter.

7. Press Intensities Decr. or Incr. in channel 1 until the AC voltmeter with 1000 Hz Filter shows exactly 120 dB less than V2. (* = number of steps, max ± 8 steps).

8. Press Store.

Calibration of Attenuator in channel 2

9. Press Intensities Decr. or Incr. in channel 2, the display will show.

0 dB on channel 2 * step(s)

10. Connect an AC voltmeter to **MP5** and notice the output V3.

11. Connect the AC voltmeter to **MP8**.

12. Adjust **P5** until the AC voltmeter shows exactly 20 dB more than V3. Notice the output V4

13. Press Frequency Decr. and the display will show .

-60 dB on channel 2 * step(s)

14. Adjust **P6** until the AC voltmeter shows exactly 60 dB less than V4.

15. Press Frequency Decr. and the display will show .

-120 dB on channel 2 * step(s)

Notice: Point 16 can only be done by use of an AC voltmeter with 1000 Hz band pass filter.

16. Press Intensities Decr. or Incr. In channel 1 until the AC voltmeter With 1000 Hz Filter shows exactly 120 dB less than V4. (* = number of step max ± 8 step).

17. Press Store.

Activate *shift* Intensity Decr in channel 2 (*off)* to leave the hardware calibration

LCD angle adjustment

Adjust by means of **P2** the LCD angel on the display to a suitable readability.

Software Calibration

General Description

Before the calibration can begin, the Set-up Item “Bone Type” in the Set-up menu, must be set to a correct value. (See list of Set-up items on page Appendix AD226 B1).
Enter the Set-up menu by activating <*shift*> Pulse key. The Item can only be changed, when the shift key is activated.
To get into Calibration menu, press <*shift*> Talk Forward, when the instrument is powered up, until the display shows “ Welcome to the AD226 Calibration “. The AD226 will now be in calibration mode.
Select the output that has to be calibrated.
Connect the output to an artificial ear or mastoid (Air or Bone), or 2ccm coupler.
To leave the Set-up menu or the Calibration Menu, press <*shift*> Decr on channel 2 (*off*).

What to do

1. Select the output to be calibrated
(Phone Right/Phone Left/Bone Right/Bone Left(=Insert Masking)/Insert phone Right/ Insert Phone Left).
Insert Phones is selected by activating <*shift*> Right or Left

2. Select input (Tone/Narrow Band/White Noise) by activating the channel 2 Intensity Keys.

3. Follow the procedure as described below for the selected inputs

Tone Calibration

See General Description above and select Tone.

1. Select by means of Frequency Incr/ Decr the frequency that is to be calibrated.

2. Activate Intensity Incr/Decr channel 1 until the desired sound pressure level has been achieved.

3. Activate STORE.

4. Go to point 1 until all frequencies have been calibrated.

5. Select a new output
(Phone Right/Phone Left/Bone Right/Bone Left (=Insert Masking)/Insert phone Right/ Insert Phone Left).
and repeat point 1-2-3-4.

Narrow Band Calibration

See General Description above and select NB in channel 2.
Follow the procedure from Tone Calibration point 1-2-3-4-5.

White Noise Calibration

See General Description and select WN in channel 2.

1. Activate Intensity Incr/Decr channel 1, until the desired sound pressure level has been achieved.

2. Activate STORE.

3. Select a new output
(Phone Right/Phone Left/Insert phone Right/ Insert Phone Left(=Insert masking)) and repeat 1 and 2.

Activate *shift* Intensity Decr in channel 2 (*off)* to leave the software calibration

Appendix A Technical Description of the RS232 Interface version 2.00

General Specification

The RS232 interface is designed to transmit data from the audiometer to a computer, and to control the audiometer from a computer.

Pin Connection

The following pins on the RS232 socket are used:

Plug for computer (25 pins)		Plug for audiometer (9 pins)
Pin number:		Pin number:
2	Received data (RXD)	3
3	Transmitted data (TXD)	2
5	Clear To Send (CTS)	8
6	Data Set Ready (DSR)	6
7	Signal Ground	5
20	Data Terminal Ready (DTR)	4

Logic Levels

Data:

Mark: "1" = -12 volt

Space: "0" = 12 volt

Control:

On: = 12 volt

Off: = -12 volt

Data Format

Data transmitted to the audiometer is and must be asynchronously and consist of:

1 start bit

8 data bits

1 parity bit

2 stop bit even parity is used

The baud rate can be selected internally (by use of set-up) between the following values: 9600,19200,38400 B/S.

Control Wires

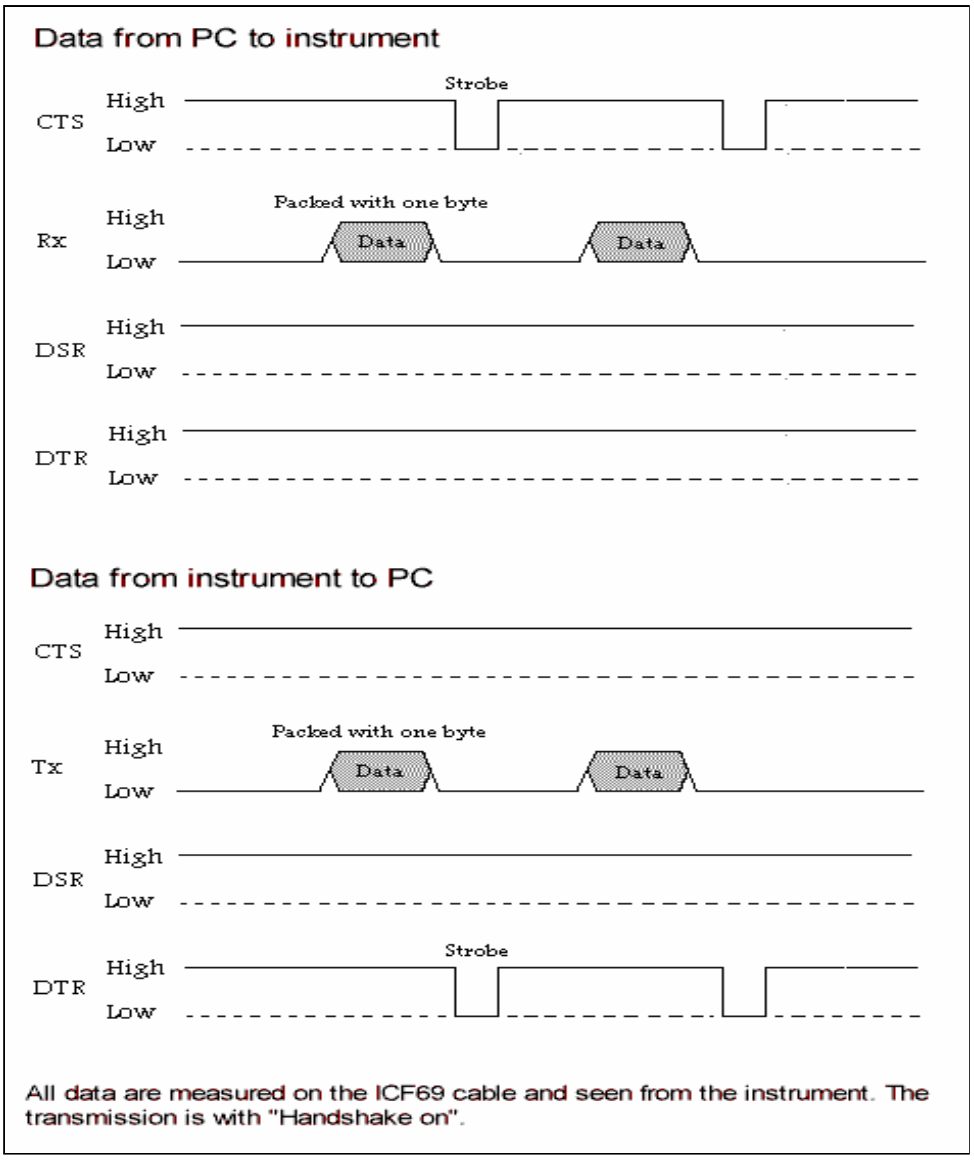
The DSR pin is always ON when the RS232 cable is connected.
The pins DTR and CTS is used for handshake in the following way:

The Computer wants to transmit data to audiometer.

1. If the CTS is OFF no data transmission is possible.
2. If the CTS is ON 1 byte can be transmitted.
3. The audiometer will send an Acknowledge pulse on the CTS (low going) on app 0.5 mS when the byte is received.

The audiometer wants to transmit data to the computer.

1. If the DTR is OFF, no data transmission will take place.
2. If the DTR is ON 1 byte will be transmitted.
3. The audiometer will wait for an Acknowledge pulse on the DTR (low going) which must be at least 0.5 mS.

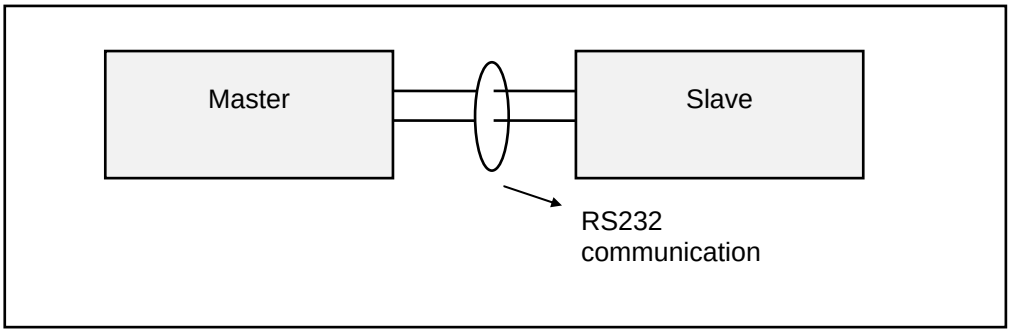


Transmission. Figure 1.

Communication

RS232 Standard for Interacoustics A/S

Both the computer and the instrument can send out a request for information or send back requested information. To make it easier to understand how the philosophy behind the RS232 communication standard works for an instrument and a PC the following terms will be used. The part that request information will be called a Master and the part who will send back requested information will be called a Slave.



Master/slave communication. Figure 2

Data transmission between the Master and the Slave are using the following format.

Data packet from a Master device.

Recipient	Sender	Direction	Header	Data

Data packet from a Slave device.

Recipient	Sender	Header	Data

“Recipient” and “sender” are revered for later use and can be ignored. Both the Recipient and the Sender are consisting of two bytes each.

A data packet form a Master will always contain a Direction. This direction tells the slave if it has to store or to send out the kind of data the header describes. The header is an indicator for the type of data and how the are transmitted.

Control Codes

All information’s in the transmission between a Master and a Slave are controlled by control codes (see table 1).

Code	Hex	Description	Code	Hex	Description
STX	02	Start of TeXt	GS	1D	Group Separator
EOT	04	End Of Transmission	RS	1E	Record Separator
SOH	01	Start Of Header	SI	0F	Shift In
US	1F	Unit Separator	SO	0E	Shift Out

Control Codes. Table 1.

A datapacket from a Master will look like this with all it’s control codes :

STX	Recipient	**US**	Sender	**US**	Direction	**SOH**	Header	**US**	Data	**EOT**

Direction can either be SO or SI. If It is a SO (shift out) direction the Master wants to send data into the slave and if it is a SI (shift in) direction the Master wants to receive data.

A datapacket from a Slave will look like this with all it's control codes :

STX	Recipient	**US**	Sender	**US**	**SOH**	Header	**US**	Data	**EOT**

Note ! When a Master is using a SO direction the slave will send back nothing !

Each time data is transmitted a US control code is added. Ex. 10 US 125 US .... With this construction it is always possible to see when all bytes in a single data transmission is completed.

Header and Data Formats

A header consists of a control code (SOH) and 6 byte (header). Each header tells witch kind of data that follows and how the data format is. The following table describes the different types of headers and there data format.

Audiological Information

Tone Audiogram

Free Field 1

Header	Description	Format
GTF100	Hearing Level	frequency US dB US frequency US ....
GTF105	Masking	frequency US masking US frequency US ....

Free Field 1. Table 3

Free Field 2

Header	Description	Format
GTF200	Hearing Level	frequency US dB US frequency US ....
GTF205	Masking	frequency US masking US frequency US ....

Free Field 2. Table 4

Insert Masking

Header	Description	Format
GTIM00	Hearing Level	frequency US dB US frequency US ....
GTIM05	Masking	frequency US masking US frequency US ....

Insert Masking. Table 5

Left Bone

Header	Description	Format
GTLB00	Hearing Level	frequency US dB US frequency US ....
GTLB05	Masking	frequency US masking US frequency US ....

Left Bone. Table 6

Left Phone

Header	Description	Format
GTLP00	Hearing Level	Frequency US dB US frequency US ....
GSLP01	Left Phone UCL	Frequency US dB US frequency US ....
GTLP05	Masking	Frequency US masking US frequency US ....

Left phone. Table 7

Right Bone

Header	Description	Format
GTRB00	Hearing Level	Frequency US dB US frequency US ....
GTRB05	Masking	Frequency US masking US frequency US ....

Right phone. Table 8

Header	Description	Format
GTRP00	Hearing Level	Frequency US dB US frequency US ....
GSRP01	Right Phone UCL	Frequency US dB US frequency US ....
GTRP05	Masking	Frequency US masking US frequency US ....

Right phone. Table 9

Test Results

Hughson/Westlake Test

To get stored data from the Hughson/Westlake test it is necessary to use the headers for LEFT and RIGHT (GTLP00 and GTRP00). This has to be so because the data from the Hughson/Westlake test is stored in the same place as the normal data.

Bekesy Test

Header	Description	Format
ATBL00	Bekesy test - left tone	Tone Type* US L/H* US M/F* US Freq US dB US... GS Tone Type* US L/H* US M/F* US Freq US dB... etc.
ATBR00	Bekesy test - right tone	Tone Type* US L/H* US M/F* US Freq US dB US... GS Tone Type* US L/H* US M/F* US Freq US dB...etc.
ATBL01	Bekesy test - left average tone	L/H US Freq US dB US Freq US dB US…. GS L/H US Freq US dB...
ATBR01	Bekesy test - right average tone	L/H US Freq US dB US Freq US dB US…. GS L/H US Freq US dB
ATBA00	Bekesy Average left phone continuos tone	Stimuli* US Masking* US Freq US dB US Freq dB US …
ATBA01	Bekesy Average right phone continuos tone	Stimuli* US Masking* US Freq US dB US Freq dB US …
ATBA02	Bekesy Average left phone pulse tone	Stimuli* US Masking* US Freq US dB US Freq dB US …
ATBA03	Bekesy Average right phone pulse tone	Stimuli* US Masking* US Freq US dB US Freq dB US …
ATBA04	Bekesy Average FF1 continuos tone	Stimuli* US Masking* US Freq US dB US Freq dB US …
ATBA05	Bekesy Average FF2 continuos tone	Stimuli* US Masking* US Freq US dB US Freq dB US …
ATBA06	Bekesy Average FF1 pulse tone	Stimuli* US Masking* US Freq US dB US Freq dB US …
ATBA07	Bekesy Average FF2 pulse tone	Stimuli* US Masking* US Freq US dB US Freq dB US …

Bekesy test. Table 10

Stimuli can be Warble (1502), Tone (1501) or Narrow Band Noise (1503).
Masking can be nothing (12), fixed (13) or synchronised (14).

Bekesy Test Categorisation

Header	Description	Format
ATBC00	Receive Bekesy Categorisation's old audio-gram	Age US MSLT* US Right Side* US Left Side*
ATBC01	Send Bekesy Categorisation's result	Right Low* GS Right High* RS Left Low* GS Left High* US

Bekesy test. Table 11

ATBC00 :
MSLT is Month Since Last Test.

The sides have 6 fixed frequencies where dB values have to be filled in.

Right Side : 500 US dB US 1000 US dB US 2000 US dB US 3000 US dB US 4000 US dB US 6000
Left Side : 500 US dB US 1000 US dB US 2000 US dB US 3000 US dB US 4000 US dB US 6000 US

ATBC01 :

Values for Right Low, Right High, Left Low and Left High are 1,2,3/4 or 5. Depending on the test result 1 and/or 2 and/or 3/4 can be send back for each of the 4 categorises mentioned above.

Information

Header	Description	Format
GDID00	Identification of RS232 version	data US
GDID01	Brand name and version	Brand name US Program Version US
GDID02	DSP program version	data US
GDID04	Instrument name and version	AD226 US Program Version US

Information. Table 12

Difference on GDID01 and GDID04 is that GDID01 returns with the brand name that can be changed by user and GDID04 always return with the same name.

Controlling the AD226

It is possible to remote the AD226 from the computer via the RS232 link with different commands. One of the commands is SPKY00 - the set key command.

Set Key Command

Keys, special keys and menu's has each a specific number that can be overruled by the RS232 link. In the following all available codes are shown and the syntax for SPKY00 is shown below.

Header	Description	Format
SPKY00	Remote command for the AD226	Code US

Set key command. Table 13

Keys are grouped the following way :

Key

Key name	Code	Key name	Code	Key Name	Code
Tone/warble	**2**	Store	**25**	Off	**50**
Autotest	**3**	Hz decr	**26**	Delete	**54**
Synch.	**4**	Hz incr	**27**	Familiarisation	**56**
Extended Range	**5**	dB decr Ch2	**28**	Headset Left	**59**
Left	**6**	dB incr Ch2	**29**	Headset Right	**60**
Right	**7**	dB decr Ch1	**30**	SISI	**67**
1/5 dB	**12**	dB incr Ch1	**31**	No Response	**69**
Manual/Reverse	**13**	Stenger	**41**	UCL/HL	**81**
Single/Multi Pulse	**14**	ABLB	**40**		
Bone	**15**	Langenbeck	**45**		

Key codes. Table 14

Beside the SPKY00 command there are other possibilities to control the AD226. With the following commands the frequency, intensity and interrupter for both channel can be set .

Header	Description	Format
SPF100	Set frequency for both channels	freq1 US freq2 US freq3 US.....
SPA100	Set attenuator for channel 1	dB1 US dB2 US dB3 US.....
SPA200	Set attenuator for channel 2	dB1 US dB2 US dB3 US.....
SPI100	Set interrupter for channel 1	“1” is on and “0” is off
SICP01	Delete all patient data	
SICP02	Reset to power-up menu	

Other remote commands. Table 15

AD226 Status

The AD226 can transmit different status information

Header	Description	Format
SGTS00	Total instrument status	*Struct Ch1* GS *struct Ch2* GS *Key* US GS Pat. Resp Left US Pat. Resp Right US GS Interrupter Ch1 US Interrupter Ch2 US
SGSS00	Stored instrument status	dB level Ch1 US dB level Ch2 US frequency US Speech % normal US Speech % stored US Store Flag US Pat. Resp. Left US Pat. Resp. Right US Interrupter Ch1 US Interrupter Ch2 US.
SGRS00	Reduced instrument status	Ch1 intensity US -15(Ch2 off)/Ch2 intensity US Ch1 Frequency US Ch1 input US Ch1 output US store flag US
SGGA00	Send all stored data	Returns with all data stored. Look for headers in the return string and see in this manual for format description.
SGME00	Menu Status	Active Menu US Submenu US

Status information’s. Table 16

struct Ch1 and *struct Ch2*

Intensity dB level US frequency US input* US phase* US output* US Bone side* US FF side* US discrimination US extended range extern US extended range intern* US stored discrimination

Bone side is '0' if Bone Left is active, and '1' if Bone Right is active.
FF side is '0' if FF2 is active, and '1' if FF1 is active.

Extended range internal is '1' if the +20 dB step is active in the audiometer but not displayed on the Extended range Key.

Key

Warble US Multifrequency US Multi pulse US Synch US Sim US Alt US Man Ch1 US HL US Single Pulse US Five dB US Man Ch2 US Store Flag US Talk Back US Monitor Ch1 US Monitor Ch2 US.

The value for the key is '1' if active and '0' if not active.

In *struct Ch1* and *struct Ch2* three types of data occurs : Input, phase and output. Each one represents a part of the way the signal is gated in the AD226 and is represented by a code

Input

Input Channel 1	Code	Input Channel 2	Code
Pure Tone	**100**	Pure Tone	**120**
Warble	**106**	Warble	**126**
		Narrow Band Noise	**123**
		White Noise	**124**

Input codes Table 17.

Output

Output Channel 1	Code	Output Channel 2	Code
Phone Left	**141**	Channel 2 off	**128**
Phone Right	**140**	Phone Left	**161**
Insert Left	**143**	Phone Right	**160**
Insert Right	**142**	Insert Left	**163**
Bone Right	**171**	Insert Right	**162**
Bone Left	**170**	Insert Masking	**165**

Output codes. Table 18

Active Menu and Submenu

Here is a table with a list of menus and submenus.

Active Menu	Code	Submenu	Code
Tone Menu	**101**	ABLB	**116**
H.W. Test	**103**	Stenger	**117**
H.W. Trainer	**104**	Langenbeck	**118**
Setup Menu	**108**		
Show Data	**109**		
SISI	**112**		
Bekesy Test	**119**		
Bekesy Trainer	**120**		
OSHA	**124**		
OSHA Trainer	**125**		

Menu codes. Table 19

EEPROM Control

It is possible to read and write the hole EEPROM using the command GDE100. If stored in a file the size will be about 4 Kbytes. Be aware that calibration values and set-up data are stored in the EEPROM. These data will be overwritten when data is transmitted back into the AD226.

Header	Description	Format
GDE100	EEPROM data	Data1 US Data 2 US .....

EEPROM control command. Table 20

Programming Tips

Interacoustics RS232 Utility Program

A test program running under WINDOWS from version 3.1, called “Coupler”, has been made for testing the RS232 functions. Further more, with this program, the NAME of the instrument and some other "fixed" parameters can be set.

AD226 OnLine

It is possible to control the AD226 Online. The following steps is an example of how it can be done.

1. Init the instrument using the SPKY00 Header.
2. Use the SGRS00 to get running information about the status of the instrument.
3. if the store flag in the SGRS00 shows “1”, send a SGGA00 header in order to get all stored data.
4. repeat from point 2.

An example of this has been made in our PrintView program. This program runs under Window 3.11 or higher and can view online data from one of our instruments and make a print out of a desired menu.

Examples of Transmission

All ASCII characters are separated form control codes with “ “ ! Ex. “00” means two byte each representing a zero.

Ex. 1 Transmitting all EEPROM data from the AD226

Master STX “00” US “00” US SI SOH “GDE100” US EOT Ask for EEPROM data.

Slave : STX “00” US “00” US SOH “GDE100” US data..... EOT Send EEPROM data.

Ex. 2 Sending all EEPROM data from to AD226

Master STX “00” US “00” US SO SOH “GDE100” US data..... EOT Send EEPROM data

Slave : Nothing.

Ex. 3 Setting a key or menu in the AD226

Master STX “00” US “00” US SO SOH “SPKY00” US “101” US EOT Switch to Tone audiogram

Slave : Nothing

Ex. 4 Getting all relevant subject data from the AD226

Master	STX “00” US “00” US SI SOH “SGGA00” US EOT	Ask for all data
Slave :	STX “00” US “00” US SOH “SGGA00” US data..... EOT	Send relevant data.

Ex. 5 Getting data - left phone from the AD226

Master	STX “00” US “00” US SI SOH “GTLP00” US EOT	Ask for data
Slave :	STX “00” US “00” US SOH “GTLP00” US data..... EOT	Send relevant data.

Window Routines in C++

In the following you will find C++ code for the PC that shows how we handle the RS232 transmission in the PC. The first function is how we transmit data to the instrument. The code is compiled with a Visual C++ 4.2 compiler as a 16 bit program.

Note this line “modem_status += 35;”. It gives the address of the modem status register for monitoring communication signals. Without this the communication will not work properly.

Transmit Data from PC to Instrument

```
IaRs232Transm(int idComDev,char FAR* source,DWORD num)

{
        unsigned int i;
        int RetVal;
        char FAR * modem_status;
        long millisec;

        modem_status = (char FAR *) SetCommEventMask(idComDev,0);
        modem_status += 35;  // this is the address of the modem_status register

        SetCommEventMask(idComDev,EV_CTS);

        for( i =0; i < num; i++,source++)
        {
                millisec = GetTickCount();
                while( GetTickCount() - millisec < 5000 ) // Wait max 5 sec on CTS
                {
                        if ( *modem_status & 0x10 ) // CTS is bit 4 in modem_status register
                                break;
                }

                if ( !(*modem_status & 0x10 )) // CTS was not on
                        return(FALSE);

                GetCommEventMask(idComDev,EV_CTS);   // Reset "CTS"

                WriteComm(idComDev,source,1); // Transmit 1 char

                RetVal = FALSE;                 // Wait til CTS will go Low
                millisec = GetTickCount();

                while( GetTickCount() - millisec < 5000 )
                {
                        if ( GetCommEventMask(idComDev,EV_CTS) == EV_CTS )
```

```
                {
                        RetVal = TRUE;
                        break;
                }
        }

        if ( RetVal == FALSE )
                return(FALSE);
    }

    return(TRUE);
}
```

Receive Data from Instrument

In the following you will find our receiving routine.
IaRs232Receiv(int idComDev,char FAR* dest,unsigned int max)

```
{

    unsigned int i,first = 0,NrOfByte;
    long millisec;
    COMSTAT comstat;

    *dest = 0;
    NrOfByte = 0;

    while(1)
    {
        millisec = GetTickCount();

        while( GetTickCount() -  millisec < 10000 )  // try in 3000 mSec
        {
            GetCommError(idComDev,&comstat);
            if (comstat.cbInQue > 0 )
                break;
        }

        if (comstat.cbInQue == 0 )
            return(FALSE);

        ReadComm(idComDev,dest,1);

        if( NrOfByte == max )
            return(FALSE);

        NrOfByte++;
        first = 1;

        for( i=0;i < DTROFF;i++)            // Acknowledge
            EscapeCommFunction(idComDev,CLRDTR);

        EscapeCommFunction(idComDev,SETDTR);

        if ( !(*dest == EOT || *dest == CR))
            dest++;
        else
        {
            for( i=0;i<10;i++)
                *dest++ = '\0';   // End of string
            return(TRUE);
        }
    }}
```

Appendix B Setting of Set-up items

Introduction

To Enter the Set-up

Hold down "shift" while activating the Pulse Key

The LCD display will now show:

Welcome to AD226 Set-up

The Set-up item number can be changed by activating the Intensity Increase / Decrease Keys in channel 2. The contents of the Set-up item can be changed by turning the HL dB Increase / Decrease Keys in channel 1. To set all items to there previous settings in one action hold down "shift" while activating the Synchr. Key when the AD226 is in calibration mode.

To Leave the Set-up

Hold down "shift "while turning the HL dB Increase / Decrease Key channel 2, or hold down "shift" while activating the Pulse key.

Restoring one Set-up item

AD226 remembers the previous setting of a Set-up item. Hold down "shift" while activating the Synchr. Key when the AD226 is in the Set-up menu. This action will restore the Set-up item to what it was before it was changed.

Set-up Items

In the following all set-up items will be shown with the factory set-up.

Set-up item 1 Baudrate

Is used to select the Baudrate (RS232 transmission speed) from 9600-19200-38400.

Set-up Item 1 Baudrate : 38400

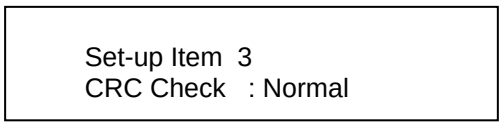
Set-up item 2 RS232 - Handshake

Is used to turn “Special”/”Normal” the handshake control between a PC and the instrument. Handshake is used with RS232 communication in order to make the flow of data correct. In some cases the computers requires this option to be “Special”.

Set-up Item 2 Handshake : Normal

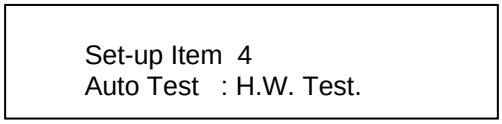
Set-up item 3 CRC Check

Is used increase safety level when transmitting data via the RS232 link. Contact Interacoustics A/S for more information about the CRC algorithm and use of the feature. Default setting is Normal.



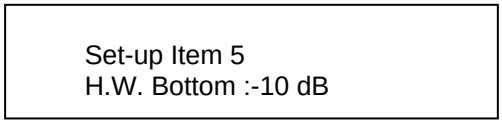
Set-up item 4 Auto Test

Is used to select what kind of auto test the key Auto Threshold will start. The choices are Hughson Westlake or Bekesy test



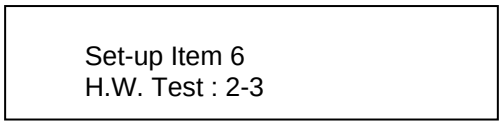
Set-up item 5 H.W. Bottom

Is used to select the lowest intensity level for the HW test.



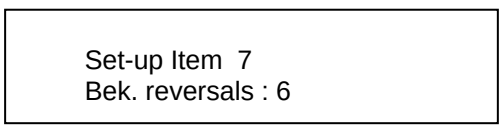
Set-up item 6 H.W. Test

Is used to select the threshold method in 'H.W. Test'. The possibilities are 2 responses out of 3 presentations, or 3 responses out of 5 presentations on the same dB value.



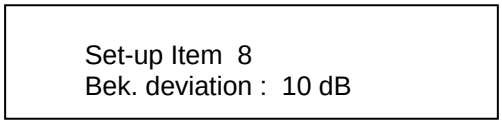
Set-up item 7 Bekesy Reversals

Is used to set the minimum number of reversals within the frequency, before a retest of that frequency will be made. The number of reversals that can be selected goes from 5 to 40.



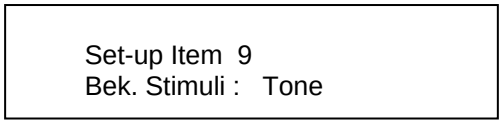
Set-up item 8 Bekesy Deviation

Is used to set the maximum dB value that the peaks or valleys must deviate among themselves, before a retest of the active frequency will be made. The deviation that can be selected goes from 5 to 60 dB.



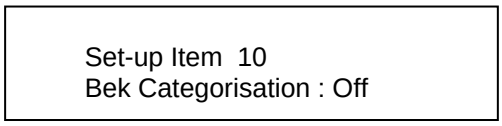
Set-up item 9 Bekesy Stimuli

Is used to select between Tone and NB as stimulus during a Bekesy test



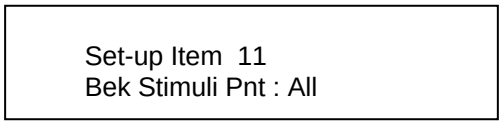
Set-up item 10 Bekesy Categorisation

Is used to set activate the Bekesy Categorisation mode.



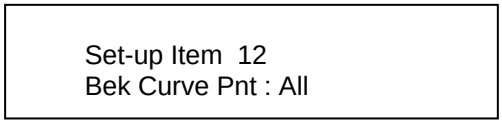
Set-up item 11 Bekesy Stimuli to Print

Is used to select the type of curve that will appear on the printout. Select between All, Continuously or Pulse stimuli.



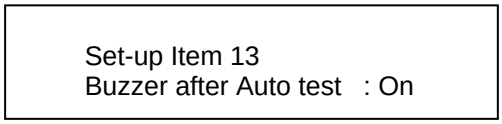
Set-up item 12 Bekesy Curve to Print

Is used to select what curve or curves that will appear on the printout. Select between All, Average or Tracing curves.



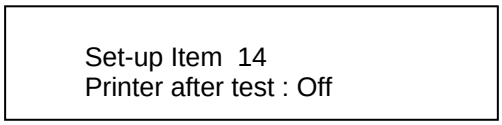
Set-up item 13 Buzzer

This item is used to select Buzzer after Auto test



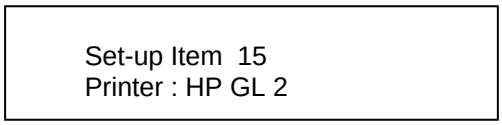
Set-up item 14 Print After Test

Is used to select if the instrument should print out automatically after the Autotest is finished.



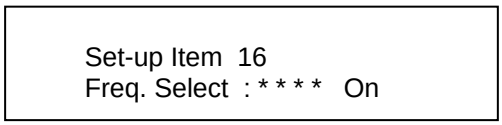
Set-up item 15 Printer

Is used to select between 3 types of printers. The choices are MTP10, HP GL 2, IBM Mode (matrix / most Ink jets) or HP PCL L3 (Hp DiskJet printer and Hp Laser printer). The IBM mode and HP PCL L3 can only be selected if the adapter IPA26 (optional) has been built into the instrument. IPA26 is not longer available.



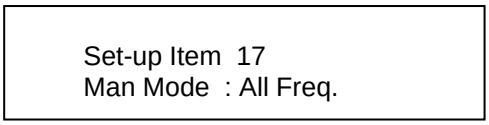
Set-up item 16 Frequency Deactivation in Auto Test

Is used to disable one or more of the following frequencies : 125 Hz, 250 Hz, 500Hz, 750 Hz, 1500 Hz, 8000 Hz. The frequencies can be selected by activating the frequency Keys.



Set-up item 17 Frequency Deactivation in Manual Threshold

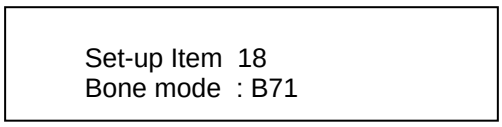
Is used to select between all frequencies or the reduced frequencies selected in item 16 in manual threshold mode.



Set-up item 18 Bone Type

Is used to select the maximum output on “Bone”, depending on the type of bone conductor used. The choices are B71 & A20

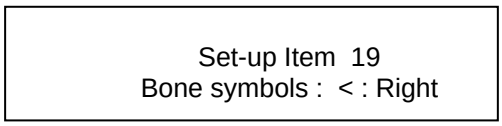
Notice: The content can only be changed by holding down "shift" while turning the HL dB Increase/decrease key in channel 1. New Calibration of Bone is necessary.



Set-up item 19 Bone Symbols

Is used to decide how the bone symbol should look on printouts. The choices are :

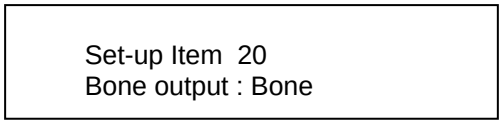
	Right	***Left***
Display shows : '< : Right'	<	>
Display shows : '> : Right'	>	<



Set-up item 20 Bone Output

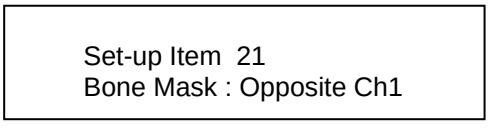
Is used to select between Bone Conductor or Loudspeaker (PLS), as the connected transducer to the bone output.

Notice: The content can only be changed by holding down "shift" while turning the HL dB Increase/decrease key in channel 1. New Calibration of Bone is necessary.



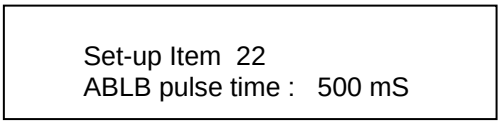
Set-up item 21 Bone Masking

Is used to select masking phone output on channel 2 when bone on channel 1 is selected.
“Insert Masking” or “Opposite Ch1” (headphones)can be chosen.



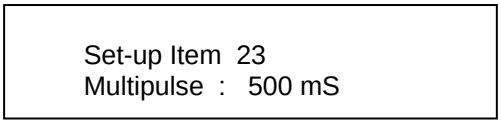
Set-up item 22 ABLB Pulse Time

Is used to select the pulse speed in ABLB mode. The pulse speed can be changed from 250 mS to 5000mSin steps of 50 mS..



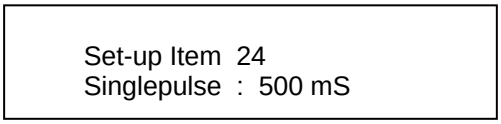
Set-up item 23 Multipulse Length

Is used to select the pulse length. The pulse speed can be changed from 250 mS to 5000mSin steps of 50 mS..



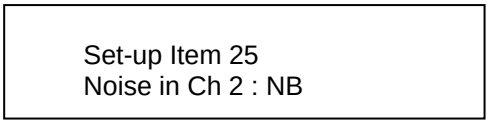
Set-up item 24 Singlepulse Length

Is used to select the pulse length. The pulse length can be changed from 250 mS to 5000 mSin steps of 50 mS..



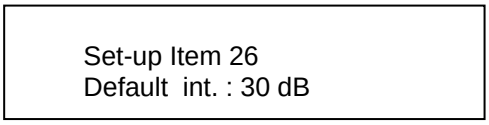
Set-up item 25 Noise in Channel 2

Is used to select between Narrow Band or White Noise for output in channel 2.



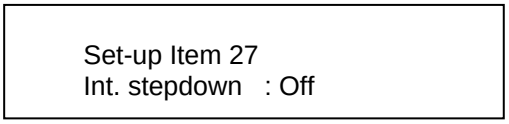
Set-up item 26 Attenuator Position

Is used to select the attenuator position when a new transducer is activated. It can be selected from -10 to 50 dB, in steps of 1 dB , or Off.



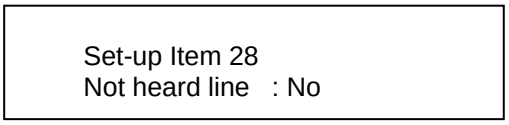
Set-up item 27 dB Value

Is used select the step-down value of the attenuator, when the frequency is changed. It can be selected from 5 to 40 dB, in steps of 5 dB , or Off.



Set-up item 28 Not Heard Line

Is used to enable/disable lines between not heard symbols on printouts.

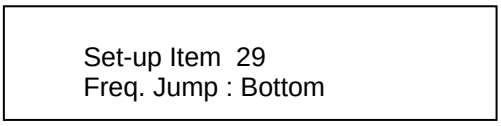


Set-up item 29 Frequency Jump

Is used to select how the frequency jumps, when activating the frequency keys. Select between Bottom and Butterfly.

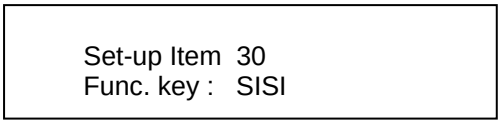
Bottom Trying to increase the frequency selection beyond 8 kHz, will cause the frequency to jump to 125 Hz, ready to perform increasing frequency selection.

Butterfly Trying to increase the frequency selection beyond 8 kHz, will cause the frequency to jump to 1 kHz, ready to perform decreasing frequency selection. Trying to decrease the frequency below the lowest frequency, will cause the frequency to go to 1 kHz ready to perform increasing frequency selection.



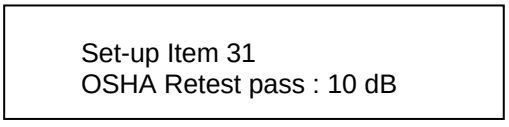
Set-up item 30 Function Key

With the function key it is possible to select between SISI, Langenbeck, Stenger or ABLB. The selected test will be the default test.



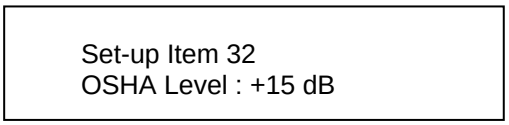
Set-up Item 31 OSHA Retest

With this option you can set a level for when the test can continue. If the threshold at 1000 Hz retest is below the value the test can continue.



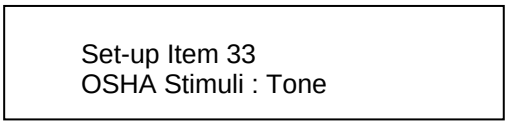
Set-up Item 32 OSHA Level

At frequency shift the OSHA Level is added to the intensity.



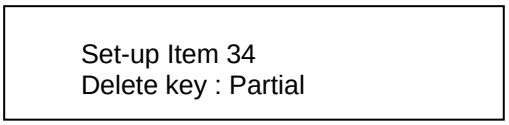
Set-up Item 33 OSHA Stimuli

What stimuli to use in the OSHA test.



Set-up Item 34 Delete Key

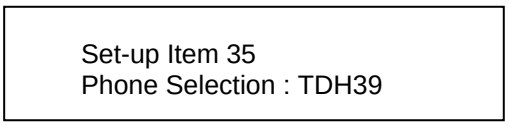
How the delete key will work. Selecting “Partial” the delete key will work as always. Selecting “All” the key will delete all data pressed once.



Set-up Item 35 Phone Selection

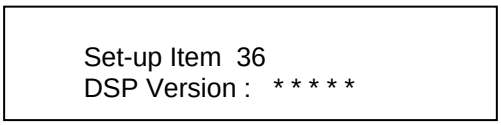
Select whether you want to use HDA200 or TDH39 as phone.

Notice: The content can only be changed by holding down "shift" while turning the HL dB Increase/decrease key in channel 1



Set-up item 36 DSP Version

This register cannot be changed, but it tells what version the DSP (Signal Source) have.



Appendix AD226 U Update News

Following Modification is made from serial 746702:

Fuse PCB 51015802
Fuse SI3 is modified to 2A

Modification revision 09/2007:

IPA26 Printer adapter is not longer available

Modification from series 552833:

New **Fuse board PCB 69029101 PCA 51015801**

To protect against shortscuts on the mains switch a fuse board is added

Modification for edition from series 338679

All ferrites L1 to L8 are replaced with 0R resistors due to intermittent measurement errors after introducing lead-free version of DSP.

Some instruments with lower serial number than 338679 may be modified.

Modification for edition from series 160326
Mainboard 67861

As a consequence of change to Power Supply UPS400, two protection Z-diodes are removed from PCB

Modification for edition from series 152375

New Program version 3.12

Modification on Set-up item 16 Frequency Deactivation in Auto Test, 500Hz is added

Previous versions 1.xx and 2.xx are modified into versions 1.41 and 2.36

Modification for edition from series 139511

New Power Supply UPS400
Replaces UPS200 – fully compatible